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TRICO

TVB370/380/390/590(E,S)/593/ 594/595/597A/591S/598/599A

DVB-T/H/T2, ATSC-8VSB/MH,

DVB-C (J.83/A, C), J.83/B,

DVB-S/S2, ISDB-T/S,TDMB,

DTMB, CMMB，DVB-C2, I/Q PLAY

**USER'S MANUAL**

Table of Contents

1. OVERVIEW

This user guide contains the information you need when installing and controlling the TVB### board.

2. PACKAGE CONTENTS

Check your PCI board package for the following items.

Items		Quantity
PCI(USB) Board	TVB370,TVB380,TVB390,TVB590(E,S), TVB593,TVB594,TVB591S,TVB595(USB), TVB597A(USB),TVB598,TVB599A(USB)	1
Bracket Assembly	BNC to BNC connector + BNC to SMB cable(TVB390v3.0,v3.1)	1
Installation USB		1
User Manual		1
USB Cable, AC Power (110/220V)Code, 19V DC Adapter	TVB595(USB), TVB597A(USB),TVB599A(USB)	1/1/1

DVB-ASI OUTPUT

RF OUTPUT

SMPTE310M OUTPUT

IF OUTPUT

(TVB380 V3.0, V3.1 PCI Board)
(Bracket Assembly)

IF OUTPUT
RF OUTPUT
TS INPUT
DVB-ASI OUTPUT
SMPTE310M OUTPUT
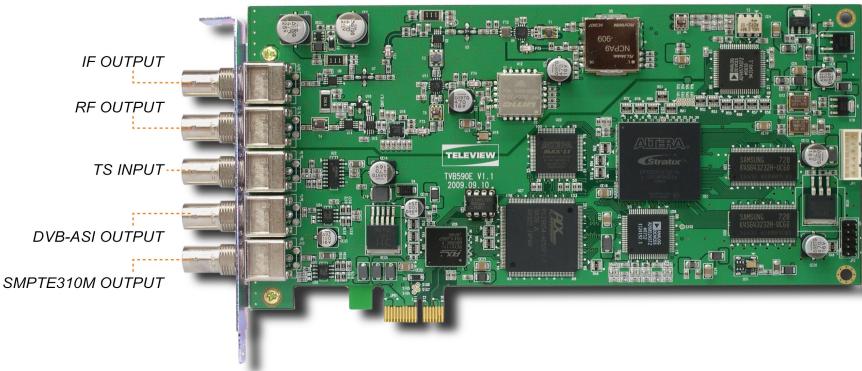
(TVB590E Board for PCI Express)

IF OUTPUT
RF OUTPUT
TS INPUT
DVB-ASI OUTPUT
SMPTE310M OUTPUT
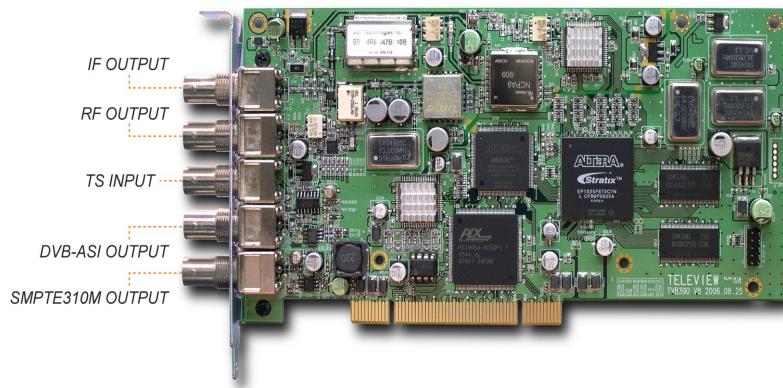
(TVB590 Board)

RF OUTPUT
TS INPUT

(TVB590S Board)
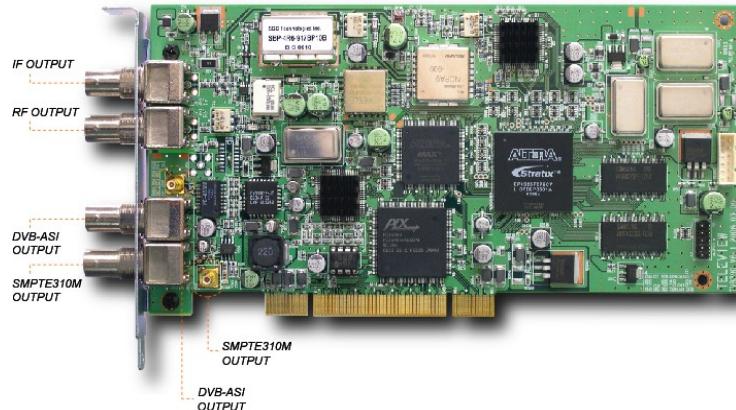
(TVB390 V6, V7 Board)

(TVB370 PCI Board). Caution: In case of IF-only version, RF OUTPUT is replaced with IF OUTPUT.

(TVB593 Board)

RF OUTPUT

TS INPUT

(TVB591S Board)

RF OUTPUT

TS IN/OUTPUT

LED

(TVB598 Board)

310 OUT
ASI OUT
TS IN
RF OUT
IF OUT

USB

DC IN
19V 3A

POWER

SERIES A TYPE

SERIES B TYPE
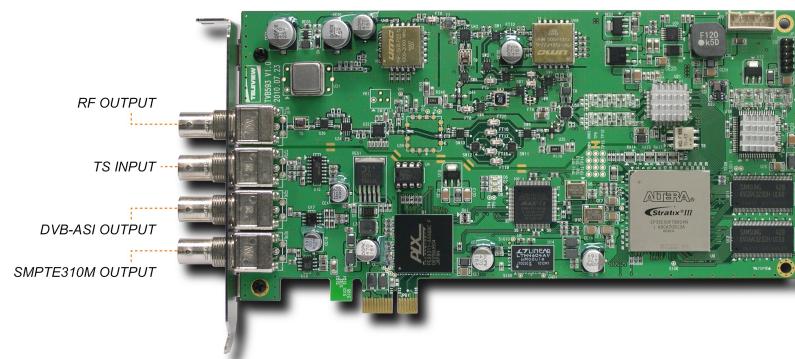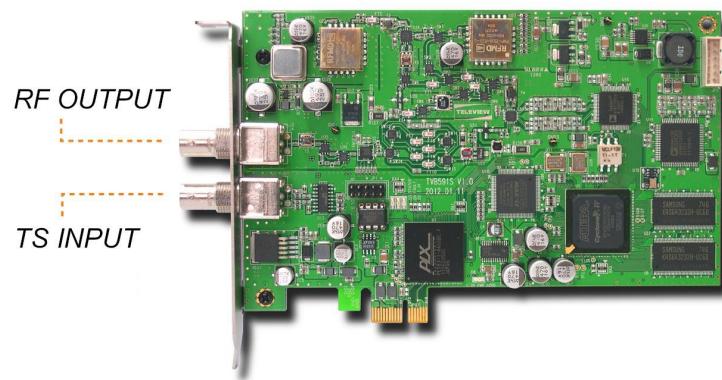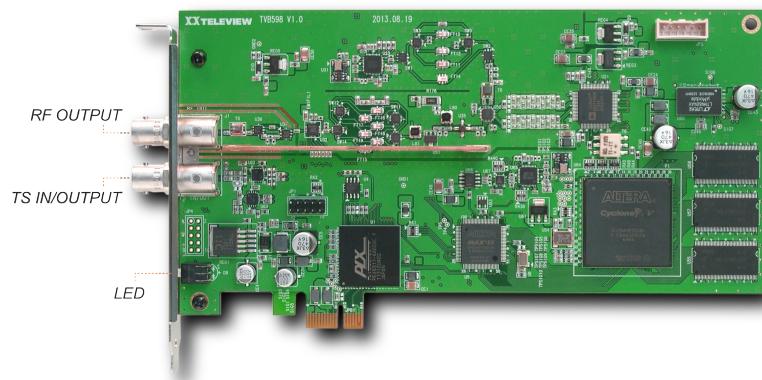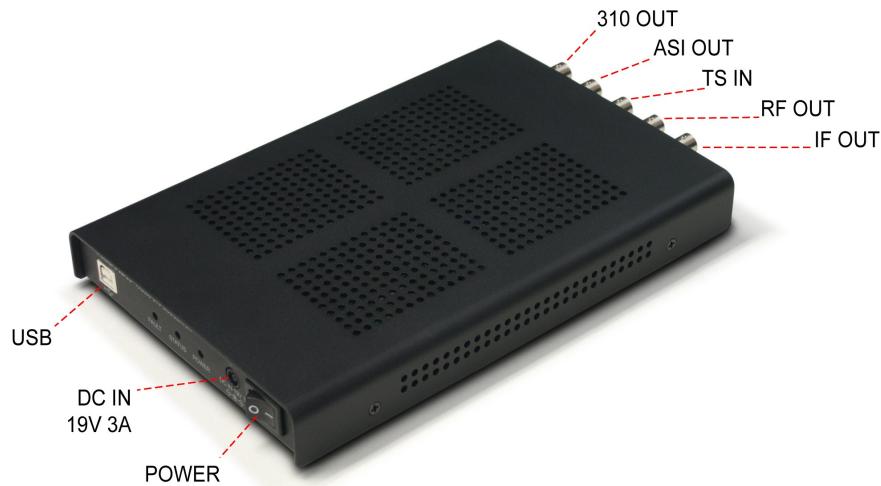
USB Cable   Stand

DC Adaptor   Power Cable 110v / 220v

ø3.00
ø8.0

ø5.90

ø1.100

ø5.00
ø5.50

ø1.00

MATE PLUG

(TVB595/597A USB Board)

USB Cable

DC Adaptor   Power Cable 110v / 220v
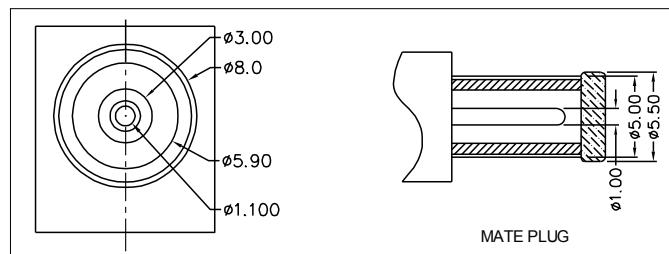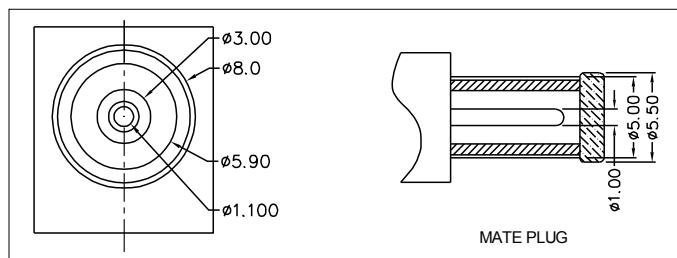
(TVB599A USB)

3. REQUIREMENTS

- Pentium PC with Microsoft Windows XP(Service Pack 2 or higher), 2000 Professional(Service Pack 2 or higher), Vista(32/64bits) or Windows 7(32/64bits) installed
- Card and cables
- USB2.0 or higher for TVB595/TVB597A.
Specially, to use TVB595/TVB597A USB board normally, high performance host PC required – **Pentium IV 3GHz and 1GB RAM or above recommended**.
This specification can be changed as modulation parameters and options.
- Installation USB (Available on ftp://ftp.teleview.com/TVB590_5_7_Windows/)
- **If TPG0590(vX.X.X)_VC package, you need the following prerequisites**
1. Windows Installer 3.0 or later in your system.
2. Dot NET Framework 2.0 or later in your system.

4. HARDWARE INSTALLATION

1. Before installing, touch the grounded part of PC to protect the board from static electricity.
2. Turn off the computer.
3. Remove the power cord from the PC.
4. Open the case
5. Assemble bracket and cables
6. Connect Bracket Assembly to PCI Board (only TVB390v3.0, v3.1).
7. Insert a board into any available PCI slots
8. Place screws to the brackets to secure the PCI board to the case.
9. Cover the case and Turn on the computer

* To install TVB595/TVB597A/TVB599A USB board, prepare a USB cable (series A/B typed). Then, connect series B type connector to TVB595 device and series A type connector to the PC. If it is the first connection, "new device driver found" message will be shown and follow the Windows device installation procedure like as TVB590 board.

* To use TVB597A board with other TVB595/USB board, Re-install the newest device driver included in the package.

* To use TVB590S board with other TVB590/PCI board, Re-install the newest device driver included in the package.

CAUTION - TO REDUCE THE RISK OF ELECTRIC SHOCK, GROUNDINGS BETWEEN PC AND DUT SHOULD BE TIED AT ONE POINT. IF NOT, IT MAKES SOME WRONG OPERATON OF PCI AND USB BOARDS.
(DUT: DEVICE UNDER TEST)

5. SOFTWARE INSTALLATION

1.   Run **Setup.exe**(D:\TVB370\380\390\590\593\595\Install\Setup.exe)
        If Dot NetFramework 2.0 or later is installed, go to step 2,

    Step 1.Click **Install** button to continue.
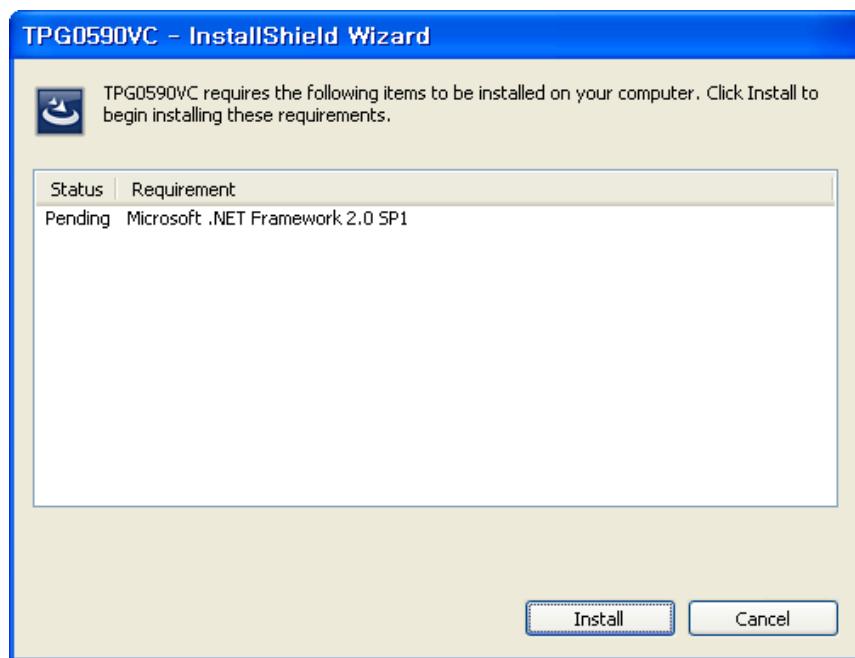

    Step 2. Click **Next** button to continue.

2. Click **Next** button to continue.
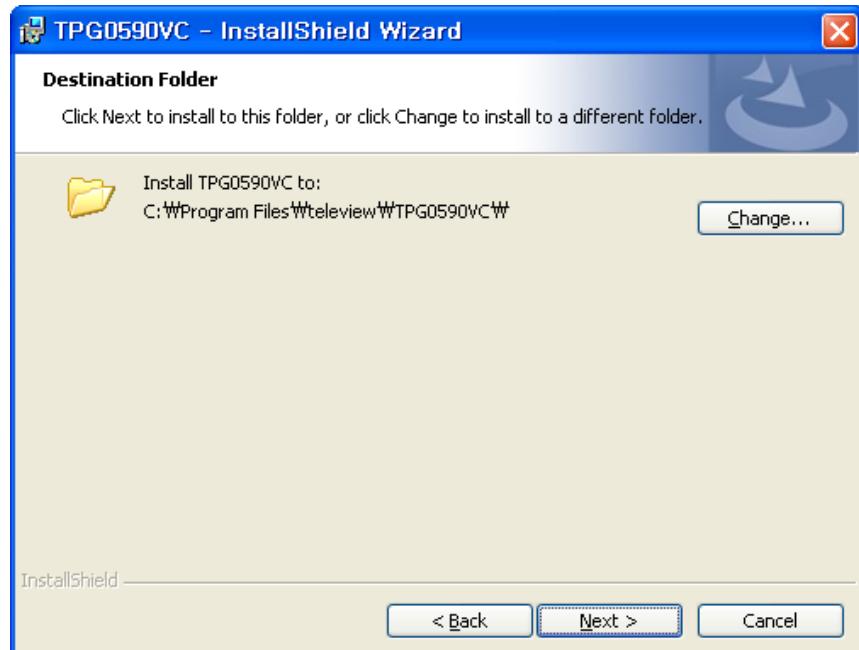

3. Click **Install** button to continue.

4. Click **Finish** button.

5. Install device driver
    5.1 Click **Next** button to continue.
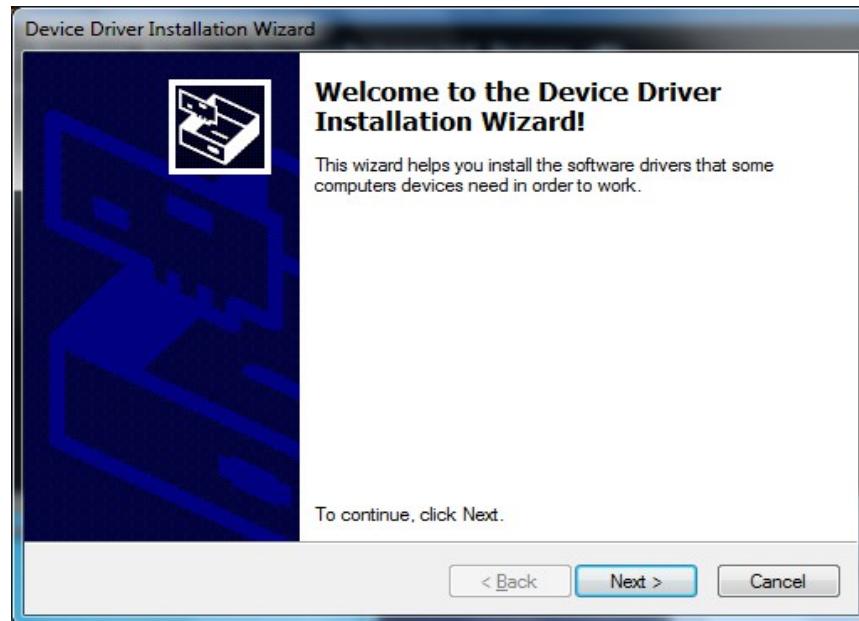
5.2 Click **Install this driver software anyway** to continue.
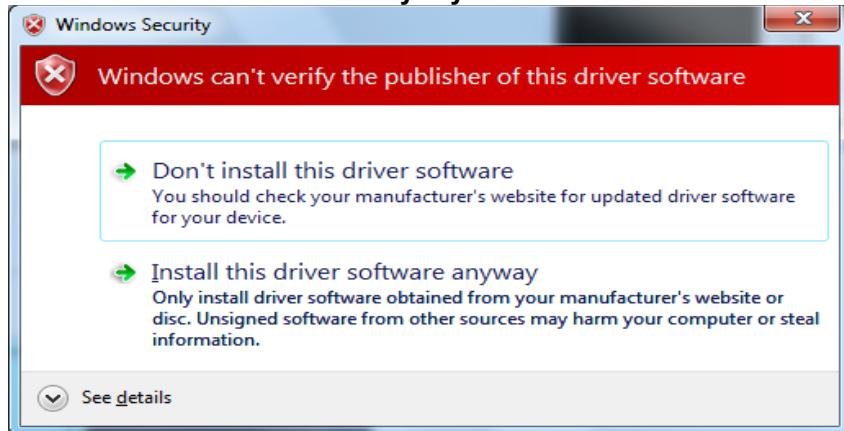
5.3 Click **Finish** button.
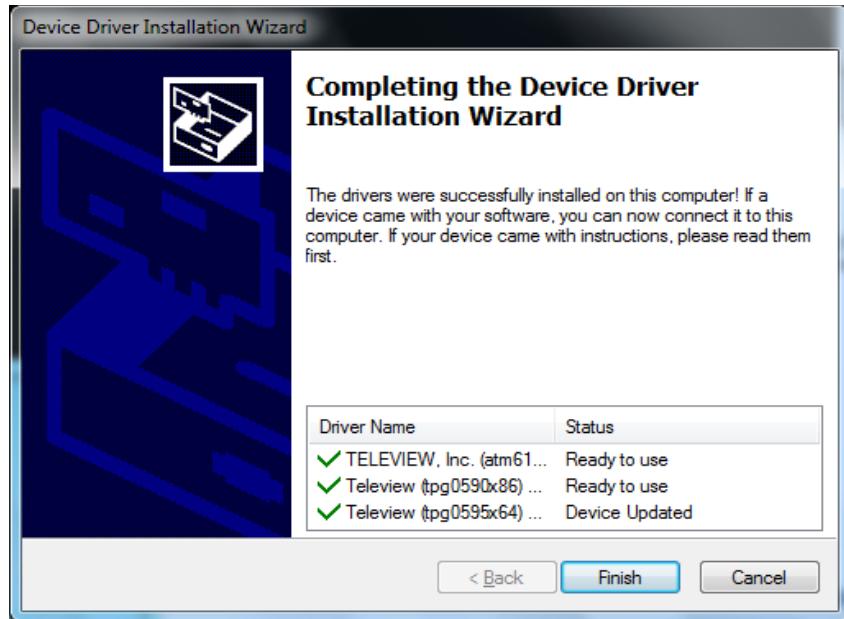
6. Completed installation of application and device driver.

6. OPERATING
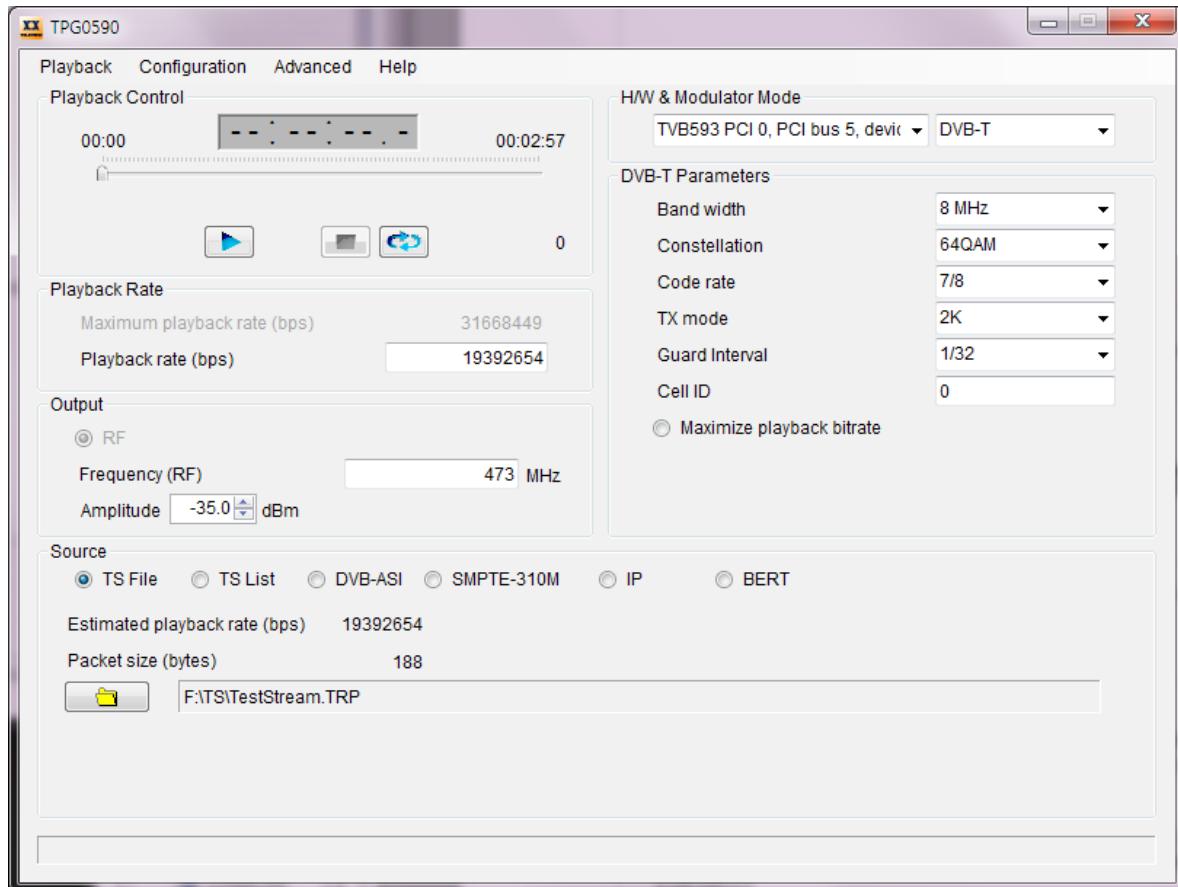
TPG0590.EXE/TPG0590VC.EXE is GUI-based control program. If you want to use consol-based application, refer to SDK's HLD/LLD demo source.

TVB370/IF is a board that only IF output is available.

TVB370/8VSB is a board that lower frequency (~79MHz) RF is available.

TVB590 is a board that TS input ports are selectable. It includes the whole function of TVB390V7.

TVB595/TVB597A is USB typed-board. It includes the whole function of **TVB590**.

In case of TVB595/TVB597A, please shut down the application before power off. **Or, it may make some damages or wrong operation**.

TVB590E is a PCI express-typed board.

TVB590S is a board that only RF output and TS input are available. **To use TVB590S properly, device driver should be re-installed with the newest device driver at the package**.

TVB593 is a PCI express-typed board and supports all functions of TVB590S and TVB597A. **To use TVB593 properly, the device driver should be re-installed with the newest device driver**. **If TVB593 is installed, do not run old s/w(v6.12.21 or lower) with TVB593 board**.

TVB594, a PCI express-typed board, support only VSB modulator and generate up to 3 RF channels. **TPG0590VC version 7.5.0 or later can support this board.**
How to use TVB594, please refer to item 8.7.
All operation is available with mouse and keyboard operation or TPG430B's front-panel keypad.
**TVB591S** is a board that only RF output and TS input are available. **To use TVB590S properly, the device driver should be re-installed with the newest device driver at the package. TPG0590VC version 7.5.5 or later can support this board.**
TVB598 is a PCI express-typed board and supports all functions of TVB593 and TVB597A. DVB-T2 FFT 16K,32K is newly supported. To use TVB598 properly, the device driver should be re-installed with the newest device driver. If TVB598 is installed, do not run old s/w(v7.8.3 or lower).
TVB599A is a USB typed-board and supports all functions of TVB593 and TVB597A. DVB-T2 FFT 16K,32K is newly supported. To use TVB599A properly, the device driver should be re-installed with the newest device driver. If TVB599A is installed, do not run old s/w(v7.8.3 or lower).

Authorization Key CONFIRM
[TVB390V7, TVB370/IF, TVB590(E,S), TVB593, TVB594, TVB591S, TVB595, TVB597A, TVB598, TVB599A] TPG0590.EXE/TPG0590VC.EXE will confirm the authorization key information.

● When the above dialog appears, put valid authorization key. The authorization key will be accompanied with the install USB or can be found on the backside of the PCI board. **If you do not have any valid authorization key, contact with PCI cards' provider and send the modulator types and the serial number, which is logged at lld_bd_##.LOG file like as**
   "EncryptedSN : C74C6DA0F2C465BA". Use an external or on-screen keyboard or mouse to put authorization key.

● To update authorization key information, refer to Authorization key at **Advanced**.

● [TVB590(E,S), TVB593, TVB594, TVB591S, TVB595, TVB597A, TVB598, TVB599A] If old TVB390 application was installed, copy the "**license.dat**" file from the TVB390 installation folder to TVB590/TVB595 installation folder before using new TVB590 application.

PLAYING FILES
- [TS File]

● Click [📁] button to select a file.

- [TS List]

● Click "Add" button to add streams to **list**.(Maximum 20)
● Click "Delete All" button to remove all streams from **list.**
● Click "Delete" button to remove one stream from **list**.

● Click **Loop Play** button [🔁].

● Click **Start Playback** button [▶].
● TS stream will be output through RF, DVB-ASI and SMPTE 310M port.

Playback Rate

Maximum playback rate (bps)	31668449
Playback rate (bps)	19392654

🔴 If the current **Playback rate (bps)** exceeds the **Maximum playback rate (bps)** (+5ppm), the warning dialog will be shown.

Warning...   ✕

Playback rate is greater than maximum value.
Maximum playback rate : 15,834,224 bps

OK   Cancel
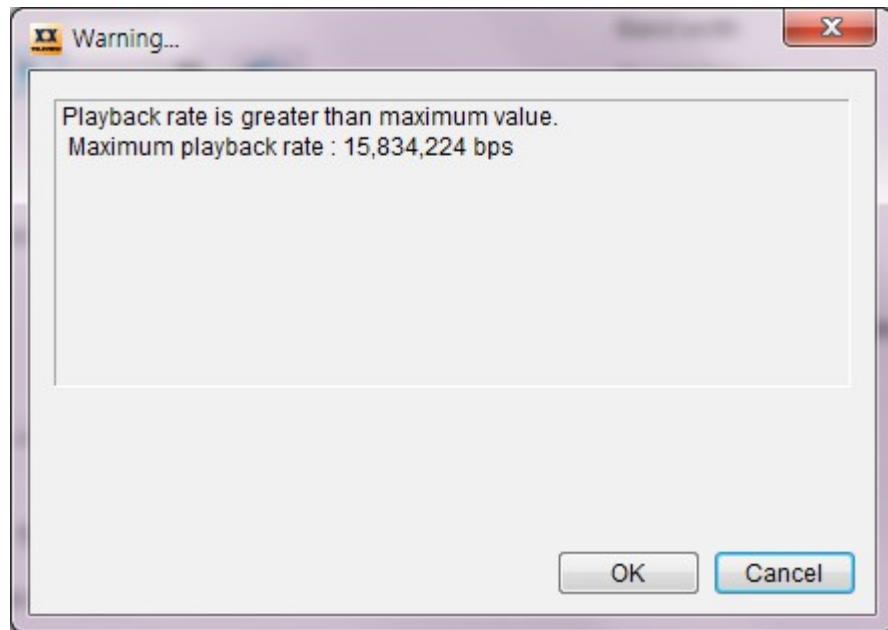
⬤ To set **Restamping on Loop**
In the menu bar, choose **Playback**. Click **Restamping on Loop...**.

| Playback	Configuration	Advanced
▶ Start Playback	Alt+P	
■ Stop	Alt+Q	
↻ Loop Play	▶	
Source	▶	
Playback Rate	Alt+R	
Interval Play...	Alt+I	
Restamping on Loop...		
View SI/PID...	Alt+V	
Exit	Ctrl+X	
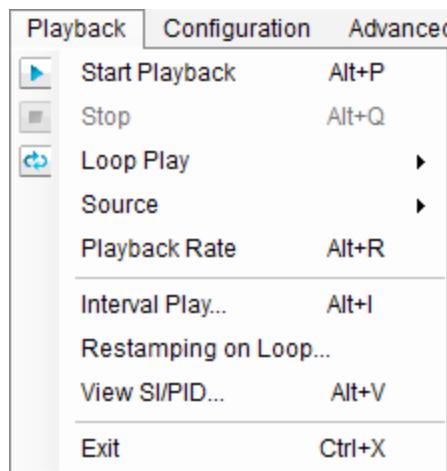
Then, **Restamping on Loop** dialog will be shown

Restamping on Loop

☐ Update PCR/PTS/DTS

☐ Update Continuity counter

☐ Update TDT/TOT

UDT Time Base

◯ Continue on Loop

◯ Use System Date/time

◯ Start with Following Date/time

2012-10-26 ▾   5:29:00 AM ▴▾

OK   Cancel
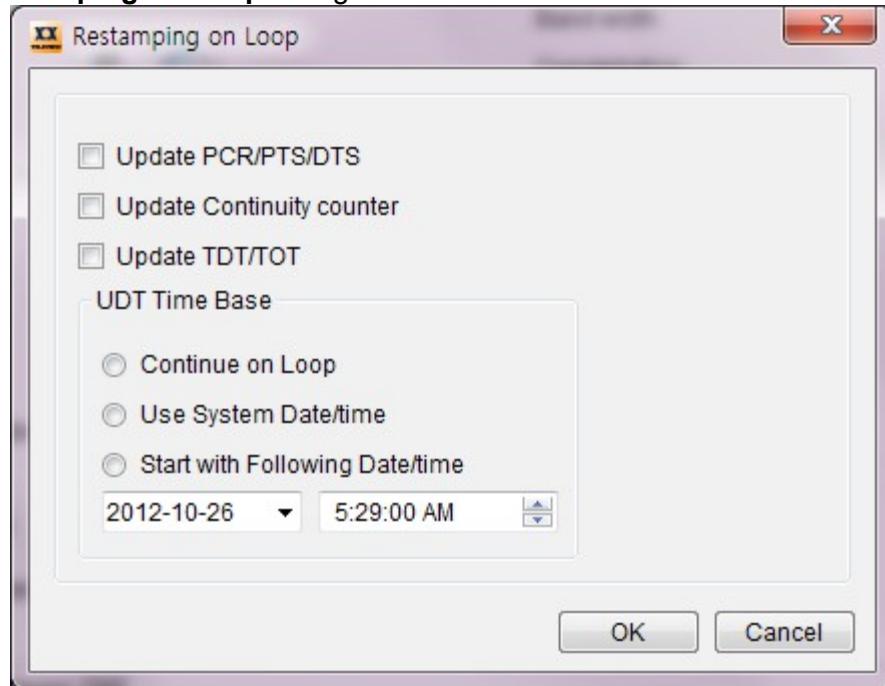
- **If source is not [TS File], this function is ignored**.
 TIP: **PCR/PTS/DTS** may be required in case of **A/V DECODING**.

🔴 To set **Interval Play**
In the menu bar, choose **Playback**. Click **Interval Play...**.
Then, **Interval Play** dialog will be shown.
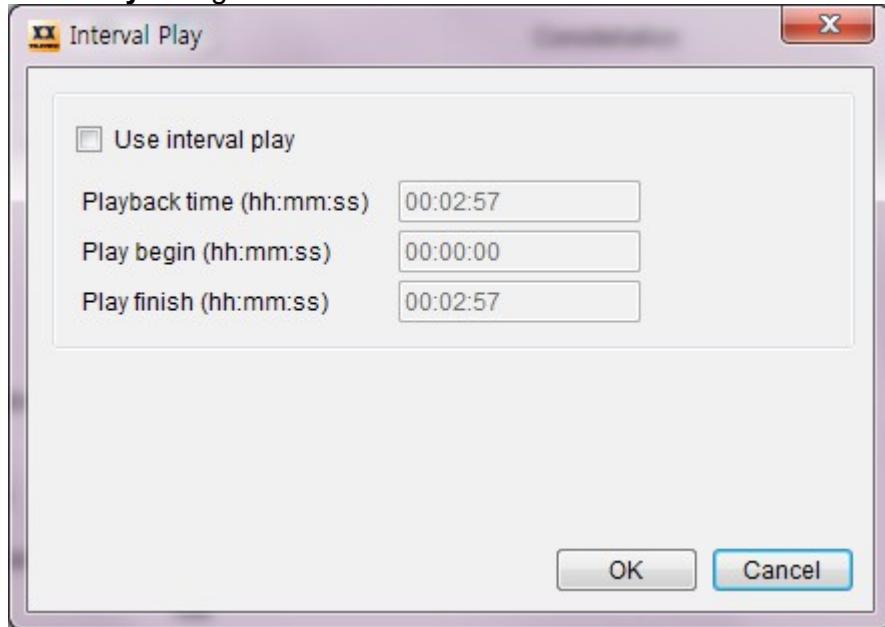
- **Use interval play** must be checked.
- **Play begin / Play finish** format must be ##:##:##.

Output control
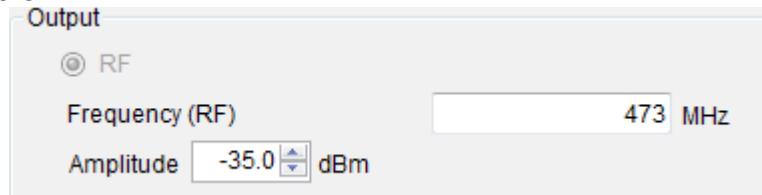
● To set **Frequency Plan**

In the menu bar, choose **Configuration, Output**. Click **RF Frequency Plan...**.
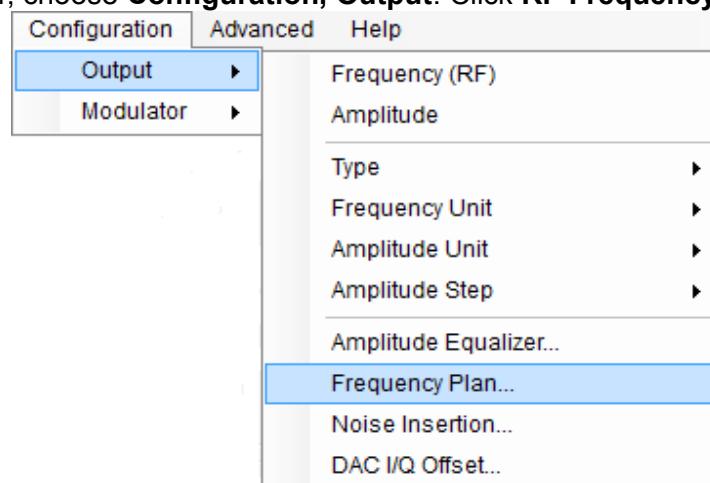
Then, **Frequency Plan** dialog will be shown.
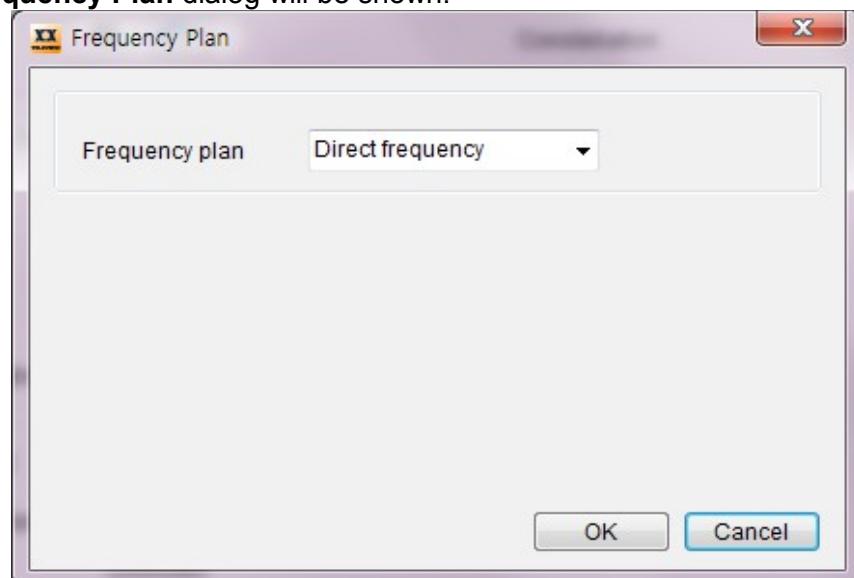
- If you want a user-defined frequency plan, select **Custom plan** at **Frequency plan** and click **Edit** button to define a new frequency plan.

<**Channel Number, Frequency(HZ)**> paired information is read from **user_channel_table.txt** file.

● You can set **IF** value as 36 or 44 MHz.

[TVB380V4, TVB380V6, TVB390V7, TVB370/IF] If two more boards are used at the same time, **IF** must be selected differently each other.

[TVB380V3] 36.125 MHz is selectable.

[TVB370/8VSB,TVB590S, TVB593, TVB591S, TVB597A (Ver.2 or higher)] **IF** is not available. By default, **IF** menu is disabled.

[TVB390V7, TVB590, TVB595, TVB597A (Ver.1)] In case of **ISDB-T**, **IF** is 35.857000MHz or 43.857000MHz.

Caution:**[V6.12.19 or higher application] IF output will be shifted as 1~999,999Hz unit RF value**.

● To change **RF LEVEL**,
- Set **Atten** value as 0~31.5dB or 0~158.5 dB if TAT4710 (external attenuator by TELEVIEW) is installed.

**How to set TAT4710.(Only 1 unit is supported.**)

1. Check the product number of the target board.
2. Close the application.
3. Click "**Start/Run...**" menu and enter "**regedit**". Click **OK** button and then "**registry editor**" will be opened.
4. Go to HKEY_CURRENT_USER\software\TELEVIEW\TPG0590_##\StartUp\USETAT4710 menu. **The ## is product number of TVB59x board.**
5. Set value as '**1**' (another board's value must be set to '**0**'.)
6. Close "**registry editor**"
7. Restart the TVB590VC application.

- RF LEVEL can be decreased linearly according to RF frequency increase. So, check AGC (Auto Gain Control) to keep a constant RF LEVEL. If AGC is checked, **Atten** range will be decreased as much as AGC **Atten** value which is shown in the tool-tip of AGC check box.

🔴 To set **C/N** with additional information
In the menu bar, choose **Configuration, Output**. Click **Noise Insertion...**.
Then **Noise Insertion** dialog will be shown.
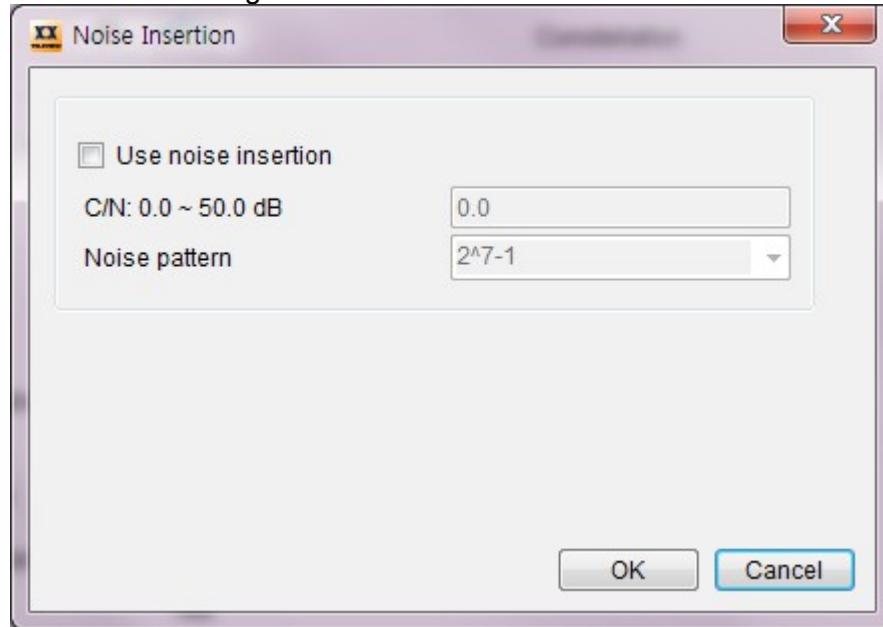
- **C/N = 0 is almost noisy. C/N = 50 which means Carrier power is greater than noise power about 100,000 times**.
- **Use noise insertion** must be checked.
- **Noise pattern** is a PRBS pattern.

MODULATOR CONFIGURATION
🔴 H/W & Modulator Mode

H/W & Modulator Mode

TVB593 PCI 1, PCI bus 4, de ▾   DVB-T ▾
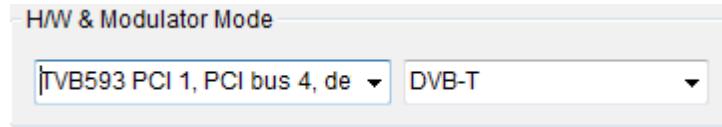
- TVB390, TVB590(E,S), TVB593, TVB594, TVB591S, TVB595, TVB597A, TVB598, TVB599A boards are selectable.
H/W naming format is "[Board Name] [Board Type] [Sequence number of Detected Board], [Location Information of Device Property]".
Ex> Board Name : TVB593,
    Board Type : PCI,
    Sequence number of Detected Board : 1,
    Location Information of Device Property : PCI bus 4, device 4, function 0
H/W name is "TVB593 PCI 1, PCI bus 4, device 4, function 0".

🔴 **Maximum playback rate** and **Minimum Symbol rate** are based on the following formula:
For DVB-T/H,

423 / 544 * Bandwidth * Code rate * Constellation * Guard interval (bps)
, Bandwidth = 5, 6, 7, 8 MHz
, Constellation = 2(QPSK),4(16QAM),6(64QAM)
, Guard interval = 4/5(1/4),8/9(1/8),16/17(1/16),32/33(1/32)

For DVB-C (J.83 A&C),
(Symbol rate / (204/188)) * Constellation
, Constellation = 4(16QAM), 5(32QAM), 6(64QAM), 7(128QAM), 8(256QAM)

For QAM (J.83 B) with 64QAM,
Symbol rate * 6 * (122 / 128) * (53760 / 53802) * (14 / 15)

For QAM (J.83 B) with 256QAM
Symbol rate * 8 * (122 / 128) * (78848 / 78888) * (19 / 20)

For DVB-S,
(Symbol rate*2 / (204/188)) * Code rate
For DVB-S2,

Symbol rate * Constellation * Code Rate * PLFRAMING efficiency * ((K$_{bch}$ − 80) / N$_{bch}$)
Constellation = 2(QPSK), 3(8PSK), 4(16APSK), 5(32APSK)
, K$_{bch}$ = number of bits of BCH uncoded Block
, N$_{bch}$ = number of bits of BCH coded Block
, PLFRAMING efficiency(Pilot Off) = (90 * NumOfSLOT) / (90 * (NumOfSLOT + 1))
PLFRAMING efficiency(Pilot On) = (90 * NumOfSLOT) / ((90 * (NumOfSLOT + 1) + (36 * Int((NumOfSLOT - 1) / 16))))
, NumOfSLOT = 360, 240, 180, 144

For DTMB,
Symbol rate * Constellation * (3744 / Frame header) * Code rate
  Constellation = 1(4QAM-NR),2(4QAM),4(16QAM),5(32QAM),6(64QAM)
, Frame header = 4200(PN420), 4375(PN595), 4725(PN945)
, Code Rate = 0.4, 0.6, 0.8
If Constellation is 4QMA-NR or 32QAM, Code rate is fixed 0.8.

🔴 [TVB590(E,S), TVB593, TVB591S, TVB595, TVB597A, TVB598, TVB599A] When ASI or 310M input is locked, it generates RF signal automatically except **ISDB-T 1/13 SEG., TDMB, CMMB, ISDB-S, DVB-T2 and DVB-C2**. In case of **ISDB-T 13 SEG.**, **DVB-ASI Direct Modulation is supported for TVB595C, TVB593, TVB591S, TVB597A**. In case the DVB-ASI TS has no 16byte TMCC information, it would be added by setting TMCC information on PARAM sub-menu.
DVB-T2/C2 support DVB-ASI Direct Modulation. (More detail, refer to 8.14)

🔴 **RF** means **Center Frequency**.
If you want to input NTSC Carrier Frequency instead of Center Frequency
- Close all applications.
- Create a string value TVB380FreqPolicy at the Windows registry as the case of RF step size. And set the value as 1.
- 1.750MHz is added to the input RF value automatically.
Refer to [**RF(Center Frequency) step size**] about Windows registry edit.
      [TVB590S] V1: **500~2000MHz** supported. V2 or higher: **55~2150MHz** supported.
[TVB593] **55~2150MHz** supported. **In case of ISDB-T, RF is shifted up to 142857Hz by default**.
      [TVB598, TVB599A] **55~2150MHz** supported.
[TVB390V7, TVB590, TVB595, TVB597A] **Caution**: **[V6.12.19 or higher application] IF output will be shifted to 1~999,999Hz of unit RF value**.

🔴 [**DVB-C (J.83 A&C)**] Symbol rate is **1~7.2MSps**.

🔴 [**DVB-S**] **If IF is 44MHz, Symbol rate 1~1.2MSps and 25~30MSps are not available. Set IF as 36MHz for whole Symbol rate**.
If RRC FILTER menu is available and it is on, the symbol rate is 1~22MSps.
      [TVB590S, TVB593,TVB591S, TVB597A V2] Symbol rate range is **1~45MSps**
      and RRC FILTER is always applied. So, by default, RRC FILTER menu is disabled.
🔴 [**DVB-S2**] **If ROLL-OFF is NONE and IF is 36MHz, Symbol rate is 2~45MSps**. **Otherwise, 2~22MSps. ROLL-OFF means the transmission RRC filter is skipped**.
[TVB590S, TVB593,TVB591S, TVB597A V2, TVB598, TVB599A] Symbol rate range is **1~45MSps.**
[TVB590S, TVB591S] ROLL-OFF/NONE menu is not available.

[TVB590C, TVB590E, TVB595, TVB597 V1]
In case of using higher symbol rate than 40Msym/s, the quality of DDS may have influence on the output performance. In this case, if user can set DDS overclocking, the quality of DDS may be better, but we cannot guarantee the lifetime of DDS chip.
In order to use DDS overclocking, follow this step.

1. Check the number of PCI slot.
2. Close the application.
3. Click "**Start/Run...**" Menu and enter "**regedit**" and click the **OK** button and then "**registry editor**" will be opened.
4. Go to HKEY_CURRENT_USER\software\TELEVIEW\ TPG0590_##\DVB-S2\AD9852_OVERCLOCK menu. **The ## is product number of TVB59x board**.
5. Set the AD9852_OVERCLOCK value as '**1**'
6. Close "**registry editor**"
7. Restart the TVB590VC application.

🔴 [**DVB-H**] **If DVB-H receivers do not support the native interleave of 4K TX mode, In-depth interleave must be checked whenever 4K TX mode is selected**.

🔴 **[TVB370/8VSB] Spectrum inversion** must be checked by default.

🔴 [**DTMB**] **It is available only at TVB590B V9.#,V10.#, TVB595B V2.#, V3.# or higher**.

🔴 [TVB380V4, TVB380V6, TVB390V7, TVB370/IF, TVB590(E,S), TVB593, TVB591S, TVB595, TVB597A]
RF(Center Frequency) step size can be controlled manually for each modulator type. By default, it is **100KHz** step **except TDMB(=8KHz, ISDB-T(1000 or 100KHz)**.
To modify default values as **KHz** unit,
- Exit all application that is running.
- Create a string value "**TVB380RFOutStep** " at the Windows registry as following:
   If the current modulator mode is DVB-T, go to HKEY_CURRENT_USER\Software\ TELEVIEW**(*)TPG0590_##\ (**)DVB-T\TVB380RFOutStep**
   And insert a step value from 1 to 1000.
   (*) TPG0590, TPG0370 or TPG0380 for each application. **The ## is product number of TVB59x board.**
   (**)Modulator type

● [**ISDB-T**] To assign user-defined layer information for **TMCC Remuxing**,
Uncheck **Use TMCC** and click **Setting...** button. Then, **TMCC Parameters** dialog will be shown. If **Use TMCC** is unchecked, the following process should be done before playing operation.

- Assign the selected PID to a layer : At PIDs table, click the last 3 columns as labeled "A", "B" or "C".
  If the selected bitrate is too high or low after assigning, edit the value without ",".
- Modify ISDB-T and Layer Parameters :
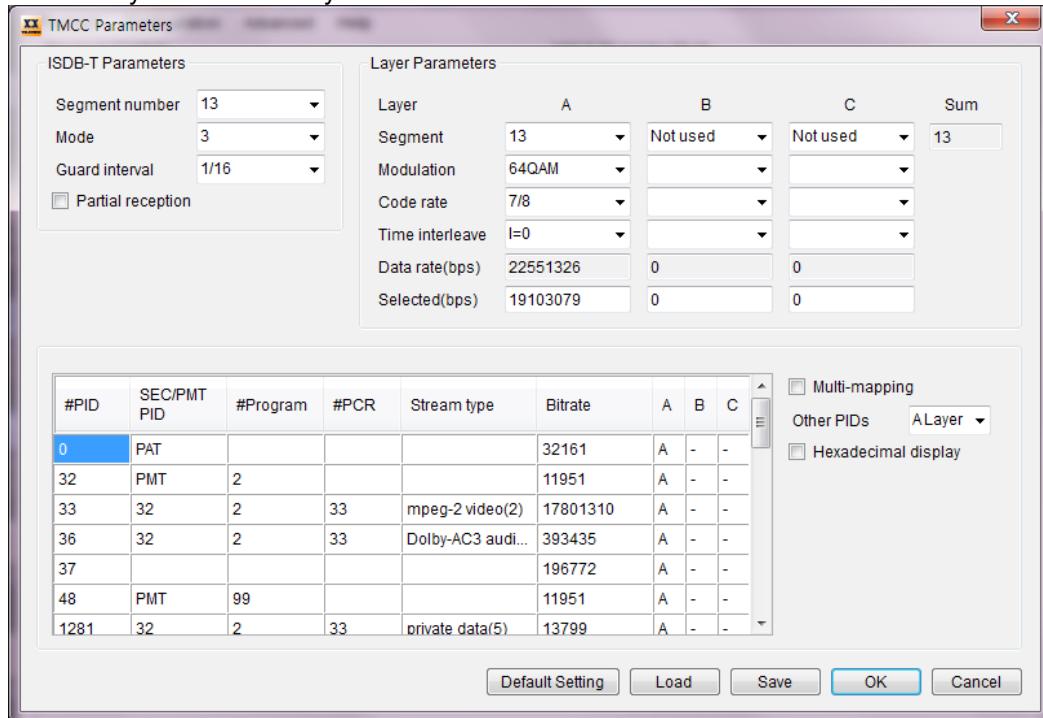
After changing any parameters and PIDs table,
please, click OK button.

- Time interleave supports only I=0 index.
- **If Playback rate at main menu is changed manually**, **please update TMCC parameters again**.
- If some parameters are invalid, the error messages will be shown in the message bar. Check the parameters including **Selected** bitrate size of each layer and **Segment** count mainly.
- User can save or load the predefined parameters and PIDs table.
- A/V Decoding is not supported at ISDB-T 1/13Segment modulation

CAUTION: If Use TMCC is checked, it assumes that the embedded TMCC information of the selected stream is used. 1Segment modulator preserves the embedded TMCC information. But, 13Segment modulator includes Delay Adjustment unlike 1Segment modulator. So, TMCC information of the (DVB-ASI)output stream can be different from the original.

🔴 [**DVB-T2**] To use Transport Stream (TS) files for DVB-T2 modulation, you should set DVB-T2 Modulation Information before playing.

First, select [TS File] for source.
Then,click **Remux...** button and **DVB-T2 T2MI Multiplexer** dialog will be shown.
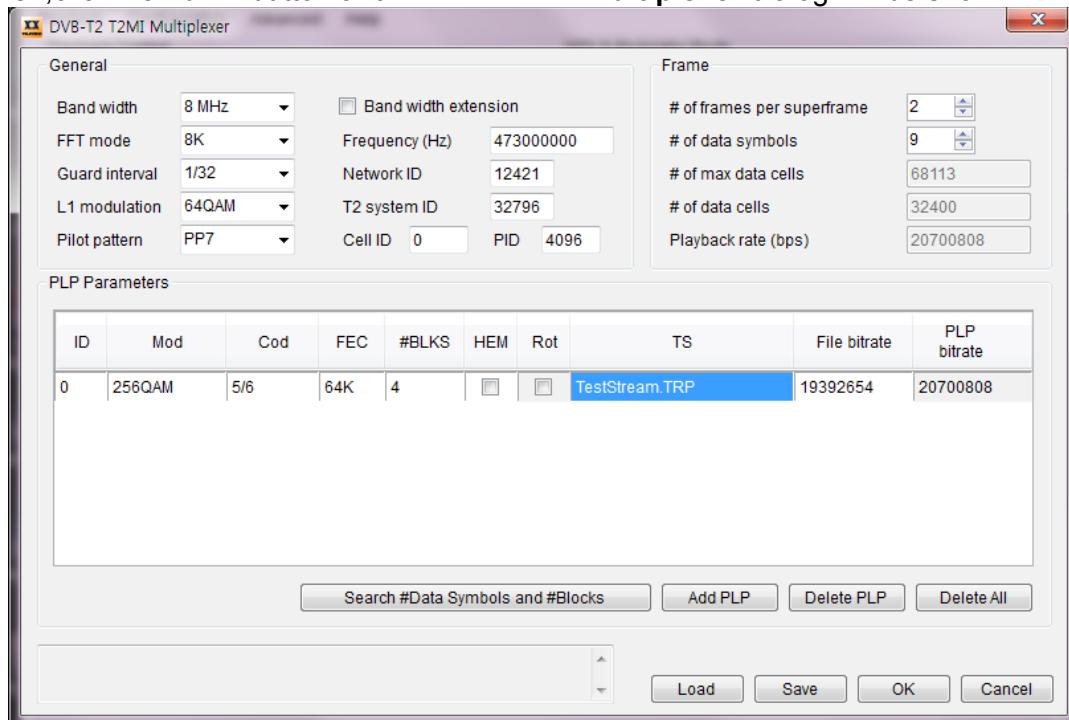
- To export the current parameters, click **Save** button. The exported file extension must be **.t2mc**.
- To import the exported parameters, click **Load** button.
- To add more PLPs, click **Add PLP** button.
  CAUTION : A maximum number of PLPs is 8.
- To remove a PLP, select the PLP then click **Delete PLP** button.
- To search automatically **# of data symbols** and **#BLKS** of each PLP,
  click **Search #Data Symbols and #Blocks** button.
- PLP PARAMETERS.
  ID : Unique identification of a PLP within a DVB-T2 system.(0 ~ 255)
  Mod : Modulation type used by the PLP.(QPSK, 16QAM, 64QAM, 256QAM)
  Cod : Code rate used by the PLP.(1/2, 2/3, 3/4, 3/5, 4/5, 5/6)
  Fec : FEC type used by the PLP.(16K, 64K)
  #Blks : PLP Num Blocks Max. Specifies the maximum number of FEC blocks contained in an Interleaving Frame for the PLP.
  Hem : High Efficiency Mode / Normal Mode selection. If checked, the PLP uses High Efficiency Mode.
  Rot : PLP Rotation. If checked, the PLP uses constellation rotation.
    It is supported in QPSK and 16QAM modulation.
  TS : Displays the selected file. When double clicking on the TS, a dialog is opened that allows you to select the file.

File bitrate : Bitrate of input file is estimated automatically.
PLP bitrate : Bitrate of the PLP is calculated based on the combination of current parameters.

[TVB599A/598] DVB-T2 T2MI Multiplexer
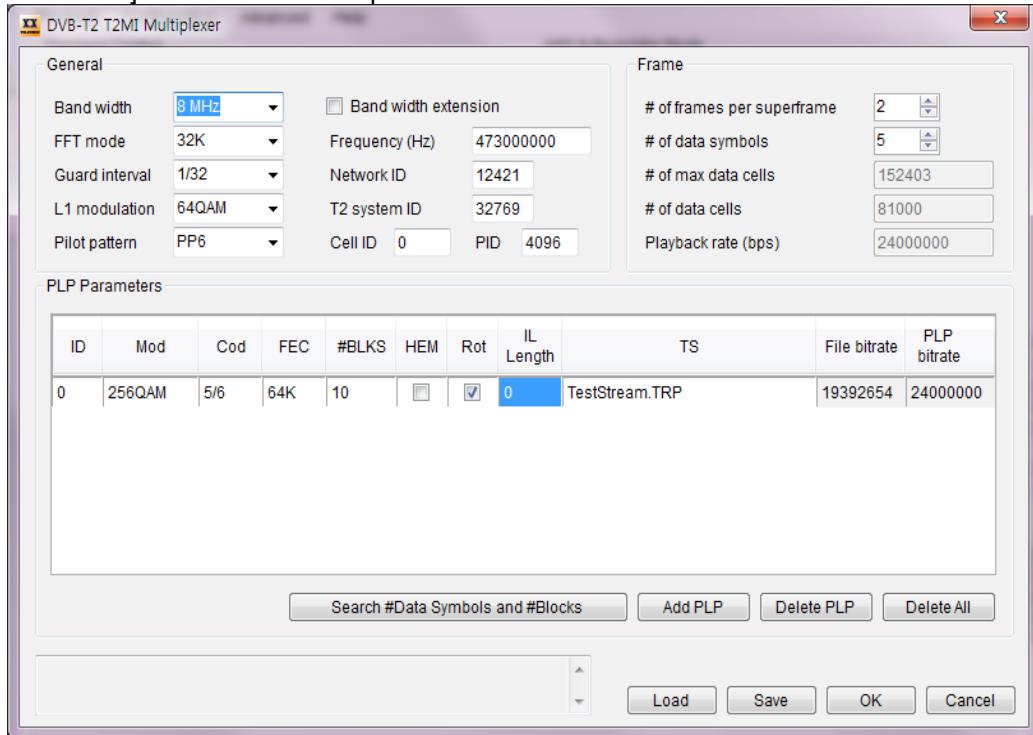
● [TVB590S, TVB593, TVB591S, TVB597A (Ver.2 or higher), TVB598, TVB599A **ISDB-S**] To combine multiple TS, use **Multi-TS combiner**. At main window, check **Multi-TS combiner** and click **Remux...** button.
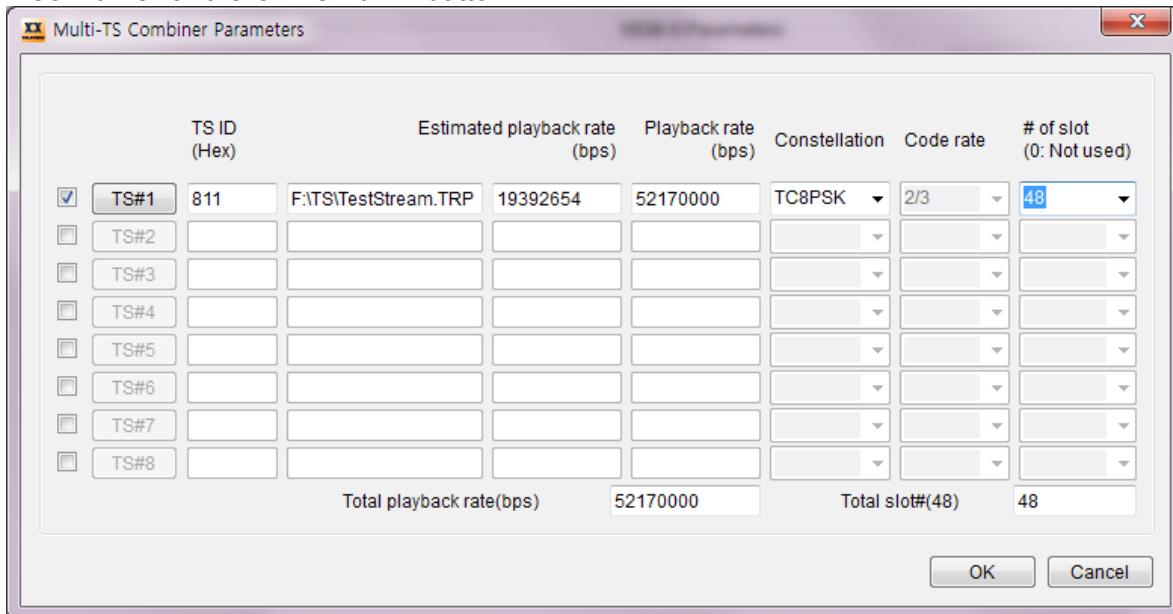
- Check **TS#** check-box. And, to assign a TS, click **TS#** button.
- For each **TS#**, set **Constellation** / **Code rate / # of slot**.
- **Total Slot# should be 48**.
- **Playback rate(bps) should be greater than Estimated playback rate (bps). If not, it will be played slowly**.
- **If TS IDs are duplicated, only one of those TS# may be received according to receicer's specification**.
- At main window, **if Multi-TS combiner check-box is unchecked, the selected TS at File list or Play list is played with Constellation / Code rate / # of slot(48) of main window**.

🔴 [**DVB-C2**] [TVB597A (Ver.1 or higher), TVB593, TVB598, TVB599A]

Click **Remux...** button and **DVB-C2 Parameters** dialog will be shown.
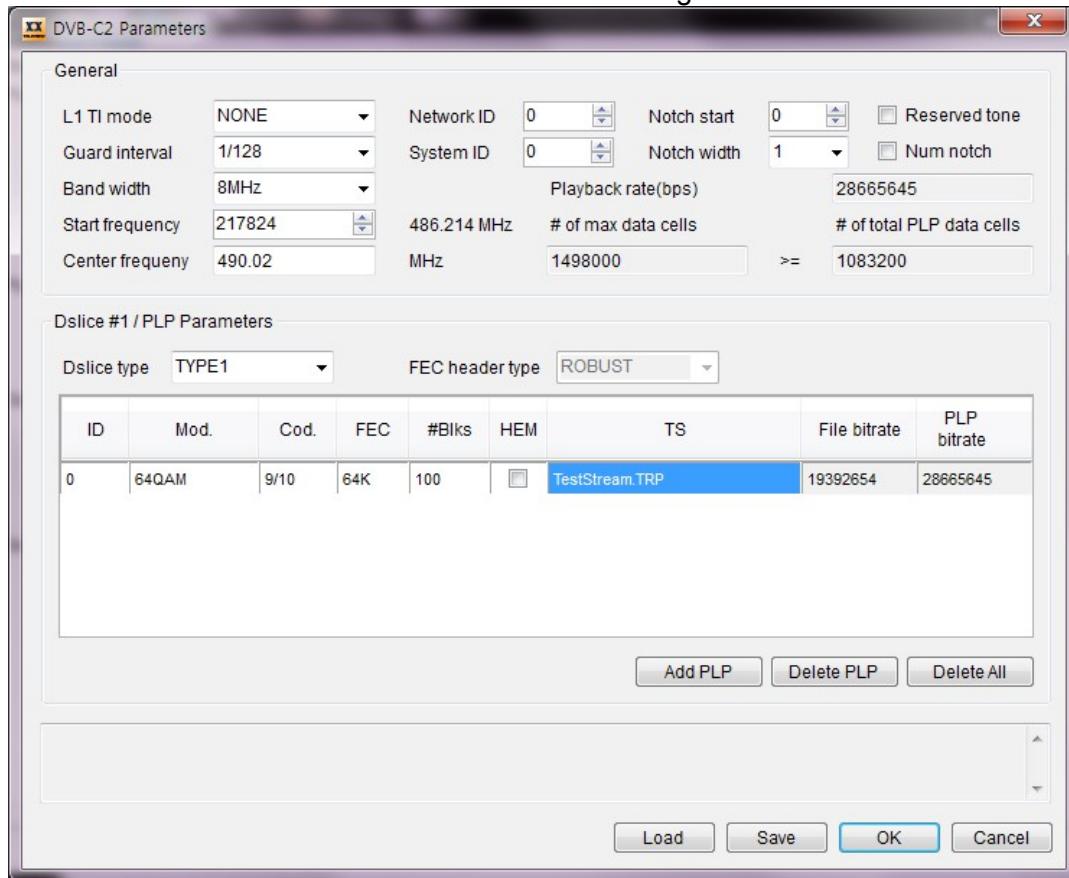
- GENERAL parameters
  L1 TI mode : Mode of time interleaving for L1-part2 of current C2 Frame.
               (NONE, BEST FIT, 4 or 8 SYMBOLS)
  Guard interval : 1/128 or 1/64
  Band width : 6, 7 or 8 Mhz
  Start frequency : Start frequency of the current C2 System by means of the
                    distance from 0 Hz in multiples of the carrier spacing of the
                    current C2 System.
  Center frequency : Center frequency.(Display only).
  Network ID : Uniquely identifies the DVB-C2 network.
  System ID : Uniquely identifies a C2 system within the DVB-C2 network.
  Reserved tone : If checked, reserved tones are activated.
  Notch start : Notch band start position relative to the **Start frequency**.
                Specified in multiples of the carrier spacing.
  Notch width : Width of the Notch band specified in multiples of the pilot
                carrier spacing. If **Guard interval** is "1/128", the value is
                1 or 2. If **Guard interval** is "1/64", the value is 1,2,3 or 4.

- DSLICE #1 / PLP PARAMETERS
  Dslice type : TYPE1(Data Slice Type1) or TYPE2(Data Slice Type2).
  FEC header type : Robust mode or HEM(High efficiency mode).
  Modulation : 16QAM, 64QAM, 256QAM, 1024QAM or 4096QAM.
 Code rate : 2/3, 3/4, 4/5, 5/6, 8/9(16K LDPC) or 9/10(64K LDPC).
  FEC : 16K LDPC or 64K LDPC.
  HEM : NORMAL or HEM(High efficiency mode).

Advanced
🔴 [**IP Reception**]
In the menu bar, choose **Advanced**. Click **IP Reception...**.
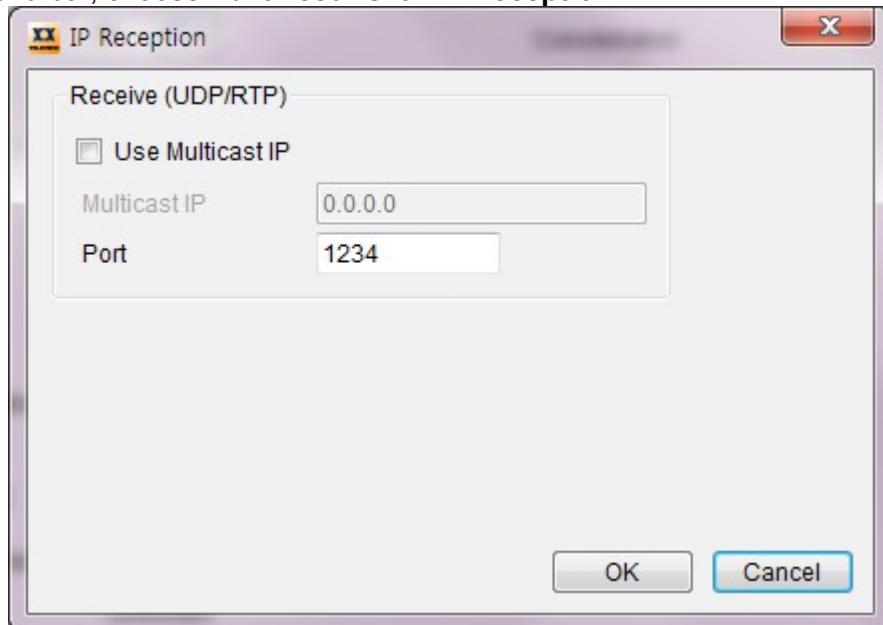
Then, **IP Reception** dialog will be shown.
IP Reception is not supported in TDMB, CMMB, ATSC-MH, ISDB-T option.
- MULTICAST IP : 224.0.0.0 ~ 239.255.255.255
- USE Multicast IP : Check this option if you want to activate the multicast IP address.
- PORT : Unique number for each board.
- Set **Source** as **IP** and click [▶] button in the main menu.

To record stream from network, click [⬤] button in the main menu.
When IP streaming is working, the current input/output rate will be updated every second.
Note: In IP mode, the input bitrate must be set in advance.(Denote br_ip be input
 bitrate of IP source. The input bitrate should be set from br_ip to br_ip + 0.5Mbps.)

● [**Playback Schedule**] Click **Playback Schedule**. You can schedule a task (Max. 5) to run daily, weekly or monthly at certain times. All schedules will be based on all parameters of **Modulator Parameters**, **Output and Advanced**.
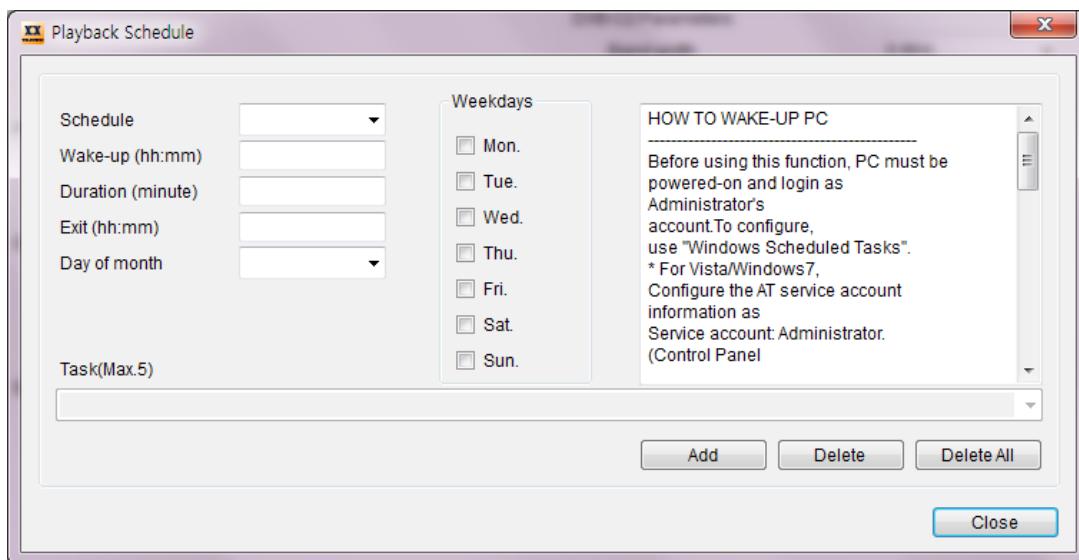

Caution: Before using this function, **PC must be powered-on and login as Administrator's account**. To configure, use **Windows Scheduled Tasks or enable Wake-up function at Power management of CMOS BIOS**.

- Add some tasks for **PC wake-up** and **login** by using **Windows Scheduled Tasks**
- Run **TPG0590VC** software.
- Select an adaptor(PCI or USB type board) and modulator type.
- All parameters must be set in advance.
- Click **Advanced** and **Playback Schedule.**
- Select **Schedule(DAILY, WEEKLY, MONTHLY or ONCE)**.
- Set **Wake-up** time (00:00~23:59) and **Duration** (minute) or **Exit** time (00:00~23:59).
- In case of vista or windows 7, the GUI is displayed only if the following configurations are done.

　　1st step : Open control panel → Administrative Tools.
2nd step : Click **Task Scheduler**.
3rd step : Click **AT Service Account Configuration**.
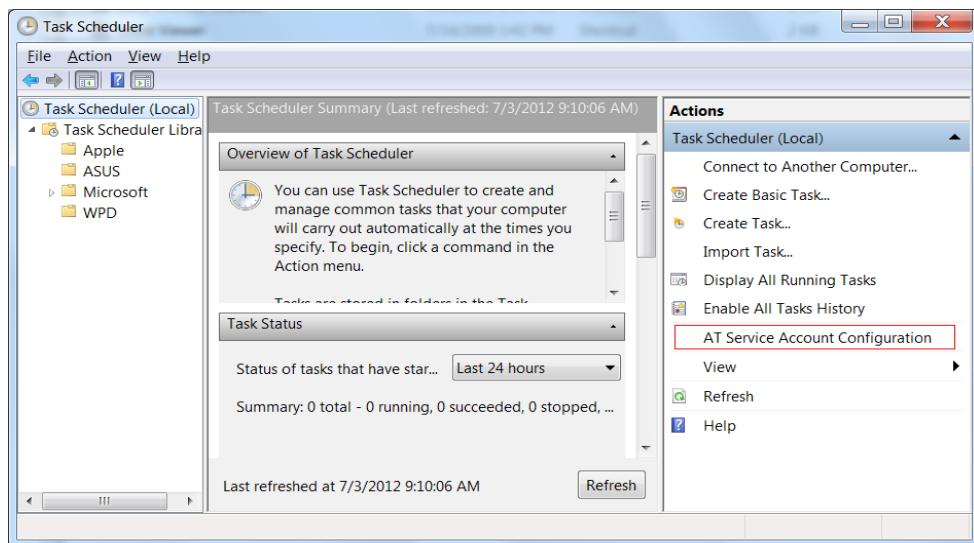
4th step : Select **Another user account**, and click **Change User...**.
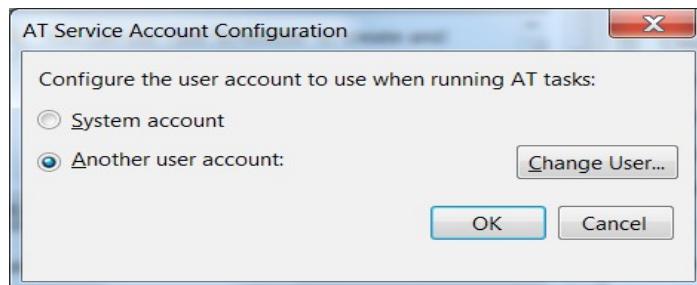
 Note : Login account must be the same as Another user account. If not, GUI is not displayed.
5th step : Login with user name and password.
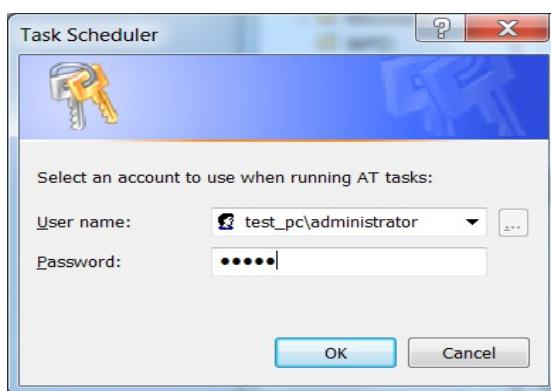
Note : If login account does not have password, please, setting password for current user account, and go to the 1st step.

🔴 [**Error Insertion**]
In the menu bar, choose **Advanced**. Click **Error Insertion...**.
Then, **Error Insertion** dialog will be shown.
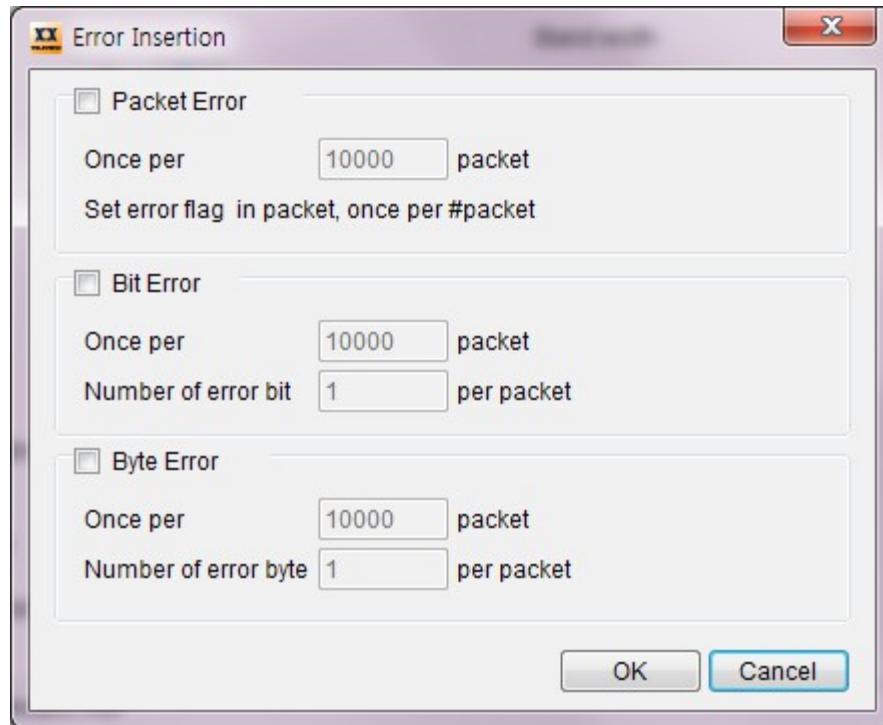
    - If **Bit Error** is checked, the packet's bits will be inverted(0<->1) from 1st bit.
    - If **Byte Error** is checked, the packet's bytes will filled with 0 from 1st byte.

🔴 [**Authorization Key**]
In the menu bar, choose **Advanced**. Click **Authorization Key...**.
Then, **Authorization Key** dialog will be shown.
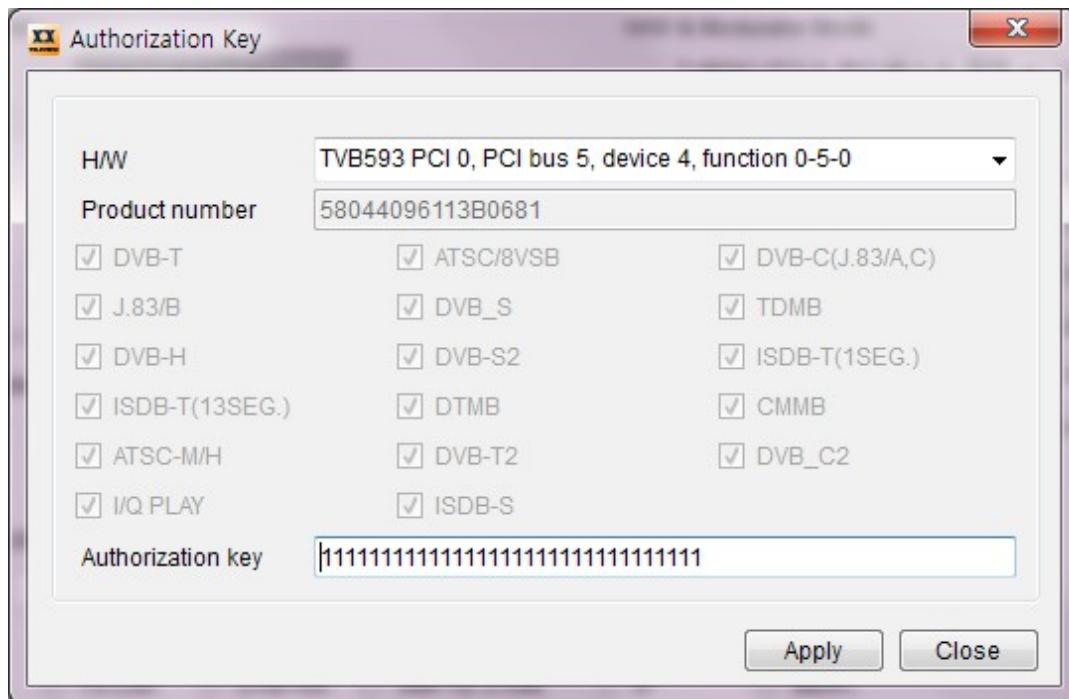
- To update the current authorization key information, select a **H/W**. Enter new authorization key at **Authorization key**. Click **Apply** button. Then, valid option for new authorization key will be marked at each check box.

● [**Preference**]
In the menu bar, choose **Advanced**. Click **Preference...**.
Then, **Preference** dialog will be shown.
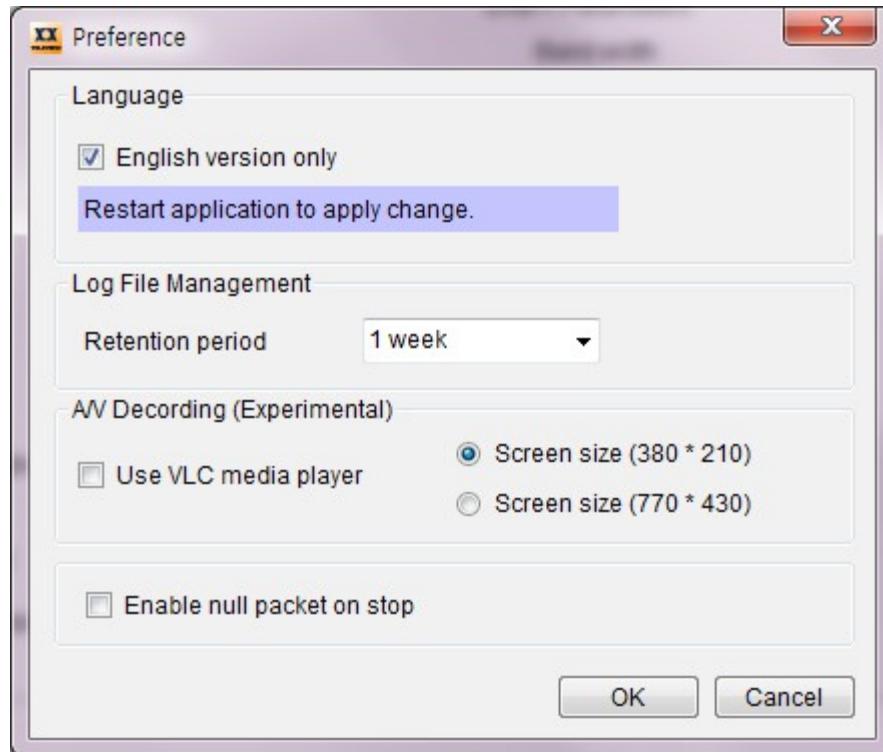
- In case of Korean locale, click **English version only** to translate to English.
  This function is available only for Korean locale.
  Other locale will be supported at the next revision.

- Log File Management: set retention period of log files.

- If you want to do A/V decoding, check **Use VLC media player**.

- Check **Enable null packet on stop** to enable null packet output on stop **except ATSC (8VSB), TDMB and ISDB-T**.

🔴 [I/Q Play Mode] **It requires I/Q PLAY modulator authorization**.
Select **I/Q PLAY** from the modulator standard list.
Click **Advanced** and click **I/Q Play Mode...**.

[I/Q Play Mode dialog]
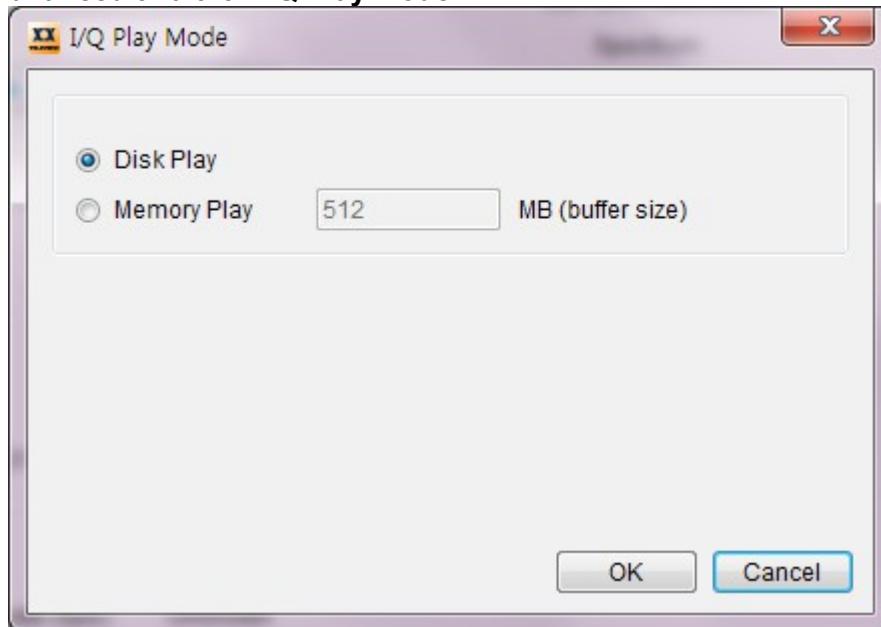
- If **Disk Play** is selected, the selected I/Q file will be played from HDD directly.
  Memory Play reads the I/Q data as much as allocated memory size from the selected I/Q file and plays the I/Q data from memory.
- The file's extension must be **.iq**.
- **I/Q File Format**

Byte (0 ~)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	…........................		
	0x 49	0x 51	0x 31	0x 34	SYMBOL RATE (unsigned integer)				I/Q DATA				I/Q DATA				I/Q DATA …........................		

- **Symbol rate(unsigned integer)**
    DVB-T/H/C2/T2 : Bandwidth(Hz) * 8 / 7
        ex> Bandwidth = 8MHz, 8000000 * 8 / 7 = 9142857
    8VSB : 10762238, DTMB : 1512000
    DVB-C, J83B, DVB-S/S2 : symbol rate * 2
        ex> If symbol rate = 5Msps, then set 10000000.
- I/Q DATA format(4byte unit) :

Bit (31:0)	31	30	29	28	27	26	…............	15	14	13	12	…...........	1	0
	C3	C2	C1	C0	I13	I12	…............	I1	I0	Q13	Q12	…...........	Q1	Q0

Continuity Counter(C[3:0]) : The continuity counter is a 4-bit field
    incremented with each I/Q DATA. The continuity counter wraps
    around to 1 when it reaches maximum value of 15.

In phase data(I data, I[13:0]) : 2's complement signed 14bits.
Quadrature phase data(Q data, Q[13:0]) : 2's complement signed 14bits.

CAUTION : **For Disk Play**, high performance HDD is required.
I/Q PLAY is currently supported for TVB590C/590S/593 only.

🔴 [**Measuring BER**]
Select **BERT** for source.

Source					
○ TS File	○ TS List	○ DVB-ASI	○ SMPTE-310M	○ IP	● BERT

BERT pattern   1: 184 (payload size) / 0 (PRBS value) ▼

BERT PID (Hex)   100

    - Select   a   BERT   pattern.

[MPEG-2 TS stream type]
TS/184/0's,**1's**,**2^15-1**,**2^23-1** is a 188 byte-packet with the first 4 bytes set to a real TS header. The remaining 184 bytes contain the playload(all 0's, all 1's, PRBS 2^15-1 or PRBS 2^23-1).
TS/187/0's,**1's**,**2^15-1**,**2^23-1** is a 188 byte-packet with the first byte set to 0x47(hex). The remaining 187 bytes contain the playload(all 0's, all 1's, PRBS 2^15-1 or PRBS 2^23-1).

$2^{23} - 1$: x23+x18+1
$2^{15} - 1$: x15+x14+1
When converted from bits to bytes,'MSB first' convention is used.

Caution: **TDMB, CMMB, ATSC-M/H, DVB-T2 and DVB-C2 are not supported**.

    - Click [▶] button.
    - Measuring   MPET-2   TS   stream   typed   BER   by   TVB590/595   board
        Prepare two TVB590/595 boards(#1, #2) and a settop(#3) to be tested.
Set the same BER type for both #1 and #2.
Connect RF output from #1 with RF input of #3.
Use DVB-ASI output from #3 as the input source of #2.
Play a stream at #1 and Record at #2.
Then, the measured BER is displayed at PLAYBACK TIME item.

CAUTION : **TVB590V8 or higher version including TVB595/TVB597A(USB) supports BERT function**.

RECORDING STREAM

[TVB590(E,S), TVB593, TVB595, TVB597A] If DVB-ASI or SMPTE-310M input is

locked, button is enabled.

🔴 Select **DVB-ASI** or **SMPTE 310M** for **Source**.

The input status and input bit rate will be updated at **message bar**.

If it is invalid status, the current input status will be shown in the **message bar**.

🔴 Click button.

🔴 The recorded stream size will be updated.

🔴 **Playback rate must be sufficiently greater than the expected input bitrate**.
   The buffering time can increase or decrease as much as the **Playback rate**.

7. CHANGES FROM TPG0590 TO TPG0590VC
<TPG0590VC is programmed by visual c++.>

7.1. SUPPORTS DVB-T2 MULTI-PLP.
7.2. SUPPORTS TVB597A VER.2.
7.3. NO NEED TO RESTART APPLICATION AFTER BEING INPUTTED AUTHORIZATION KEY.
7.4. DISABLED CHANGING SOME CONTROL BUTTONS WHILE PLAYING OR RECORDING.
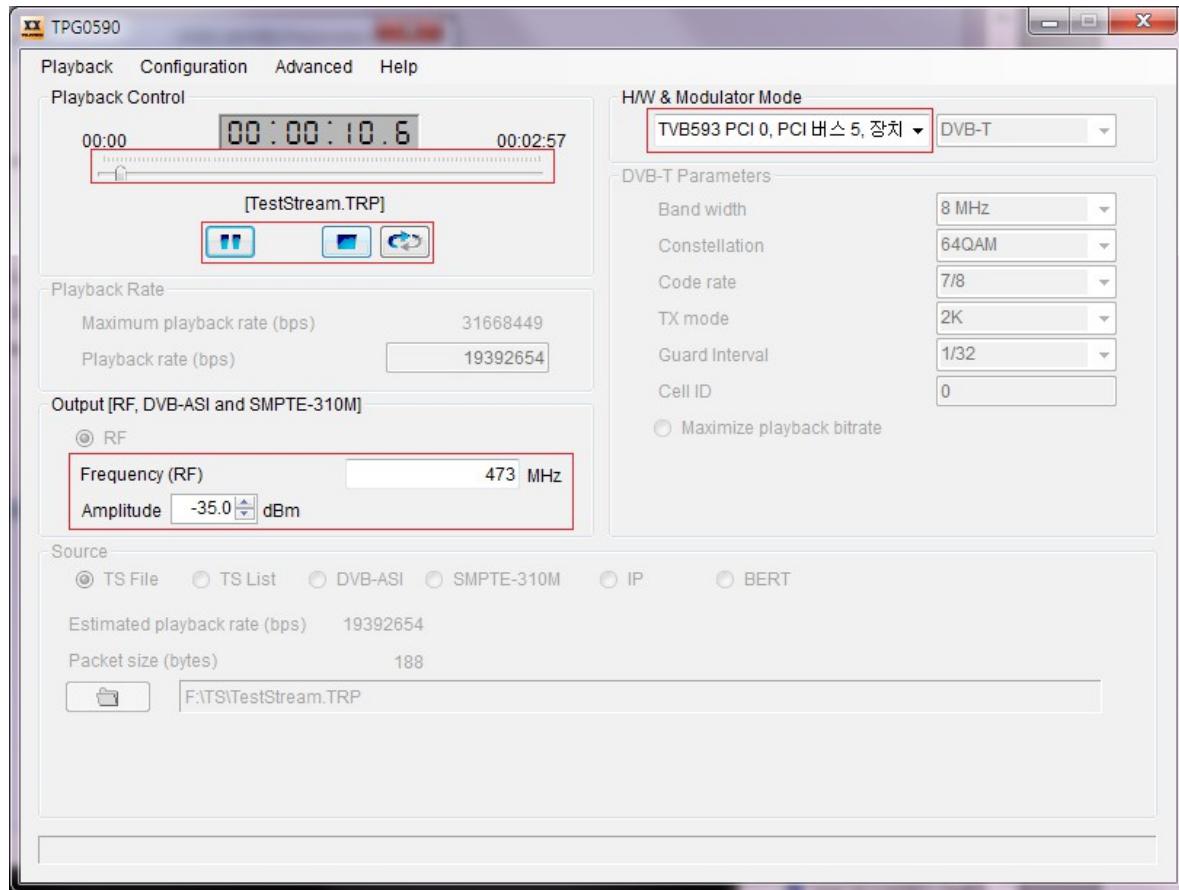
In Red box, user can change parameters while playing or recording.

7.5. DAC I/Q OFFSET

To minimize LO leakage and increase RF quality, DAC I/Q offset value should be adjusted by DAC Compensation menu in TVB590S, TVB593, TVB597 V2.x, TVB598 or TVB599A

An optimized value of the DAC I/Q offset is selected based on the quality of RF frequency.

The DAC Compensation menu is enabled when TVB590S, TVB593, TVB597 V2.x, TVB598 or TVB599A boards are detected. Refer the example instruction.

<Tuning DAC I/Q offset value at RF freq 450MHz with Spectrum Analyzer>

step1. Connect RF OUT port of TVB59x board to a spectrum analyzer with a BNC cable.

step2. Set the RF Frequency as 450MHz

step3. In the menu bar, choose Configuration, Output. Click DAC I/Q Offset....
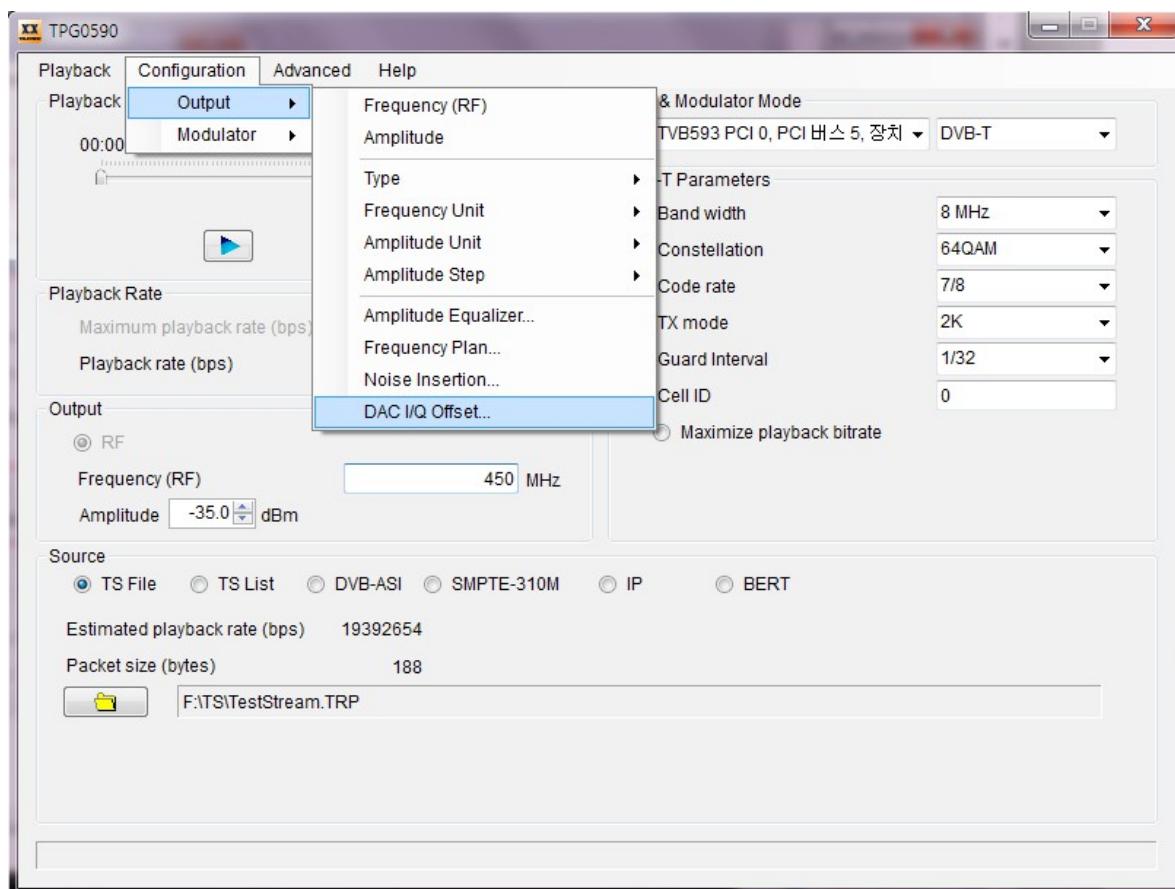
step4. Select the Modulation mode as fs/4 to watch hidden LO leakage signal.
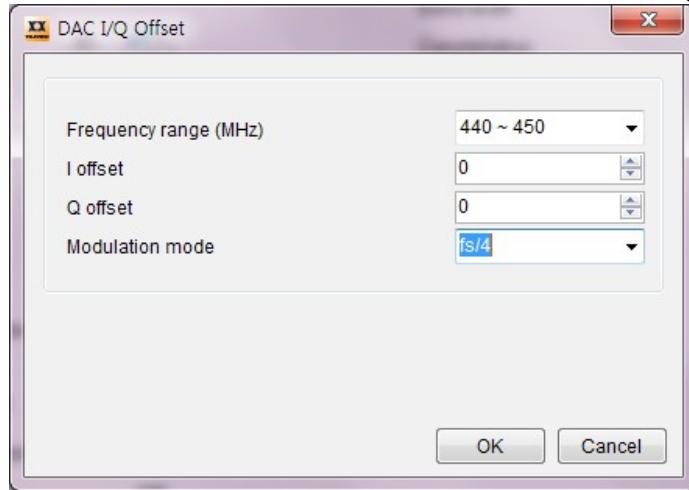
FIG. Modulation mode : fs/4

Then, user can observe the LO leakage on the spectrum analyzer.
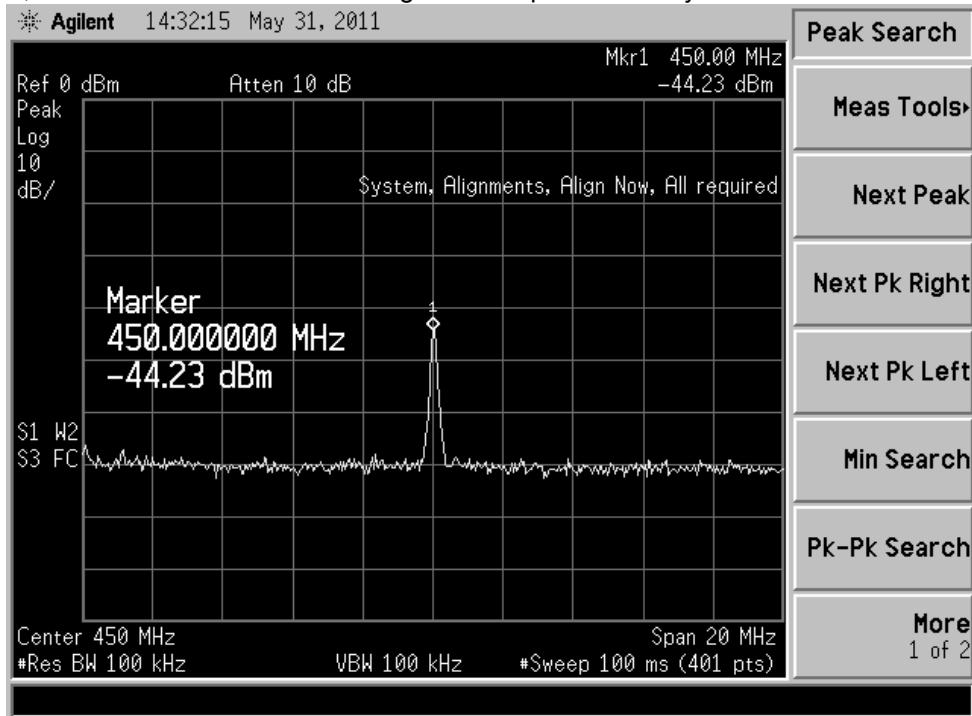
FIG. Leakage waveform before tuning DAC I/Q offset

Step5. Adjust the DAC I/Q offset value to minimize the LO leakage signal on watching the spectrum analyzer. The proper DAC I/Q offset value can be minimized the LO leakage signal. At first, increase or decrease the I offset value to be the lowest LO leakage signal. And then increase or decrease the Q offset value to be the lowest LO leakage signal. But it is not important the order of I/Q adjustment.
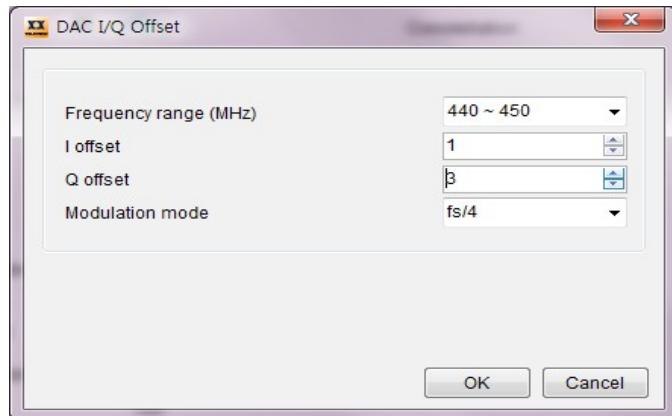
FIG. DAC I/Q offset value adjustment
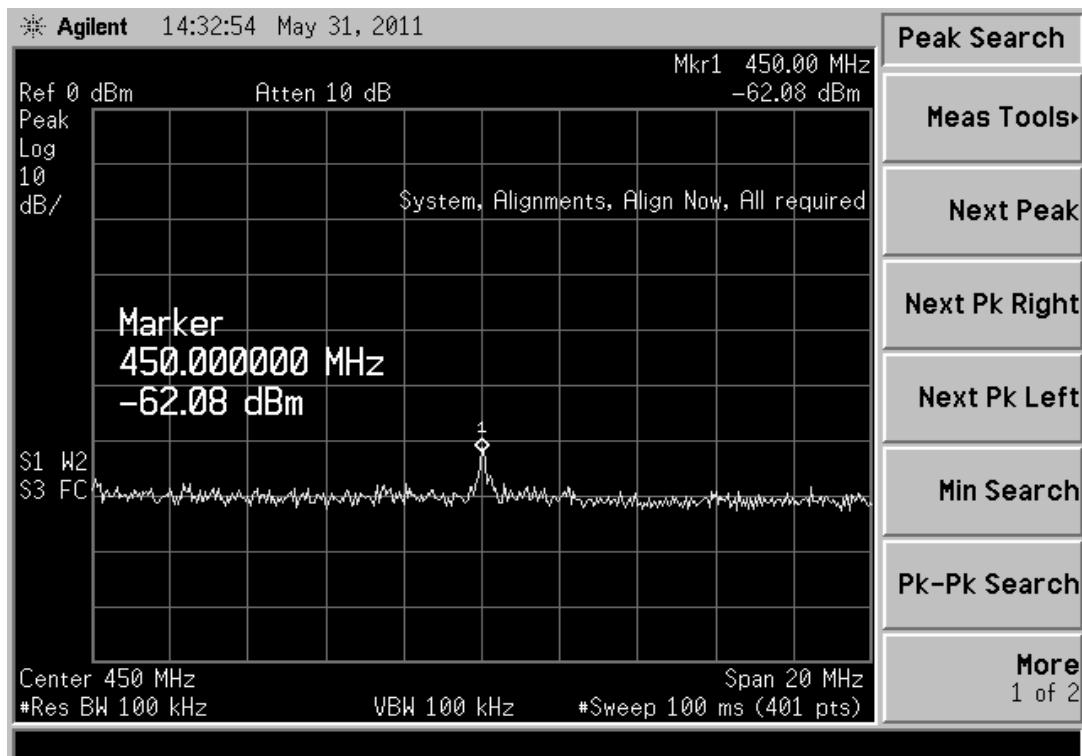
FIG. Leakage waveform after tuning DAC I/Q offset

Step6. Select the Modulation mode as None. And click **OK** button.
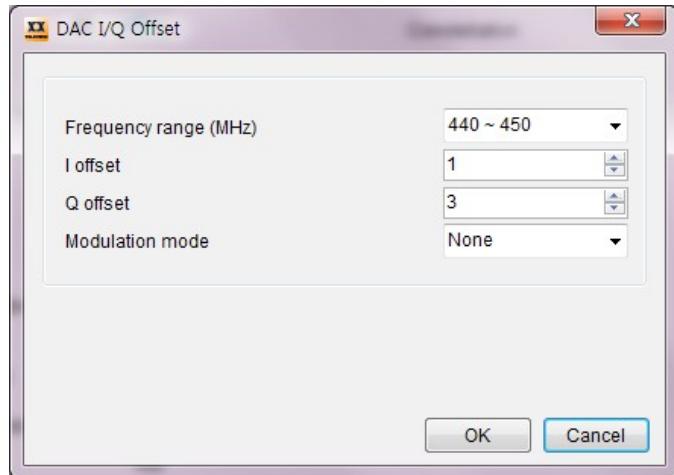
FIG. Modulation mode : None

Then, user can observe the 450MHz RF waveform on the spectrum analyzer.
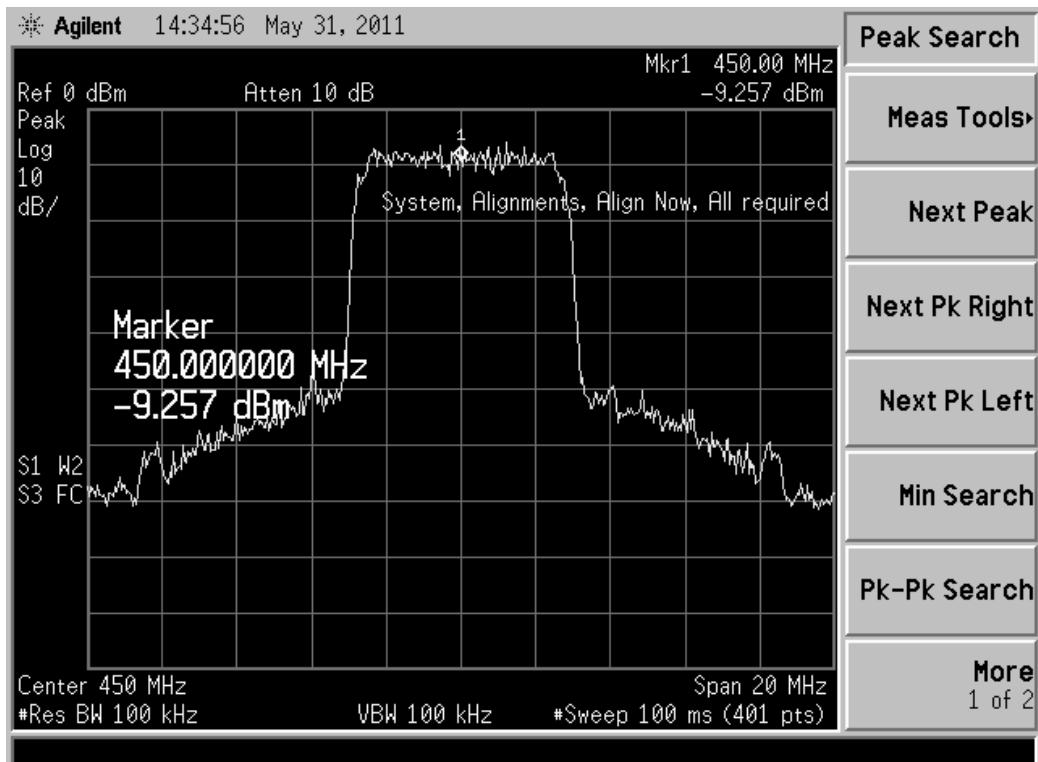
FIG. RF waveform after tuning DAC I/Q offset

<Indirect tuning DAC I/Q offset value without Spectrum Analyzer>

If user want to adjust DAC I/Q offset value without spectrum analyzer, it needs to prepare the receiver that can display the RF quality (SNR or C/N value).

It is possible to adjust DAC I/Q offset value indirectly on watching SNR or C/N value of the receiver.

To get higher SNR or C/N value, at first increase or decrease the DAC I offset value and then increase or decrease the DAC Q offset value.
Note that the Modulation mode should be None, and the order of I/Q adjustment is not important.
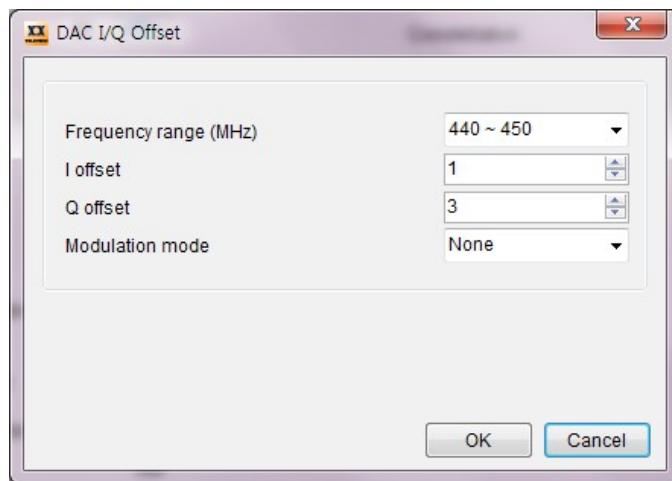

FIG. Modulation mode : None

7.6. PAUSE IS SUPPORTED WHILE PLAYING A FILE.
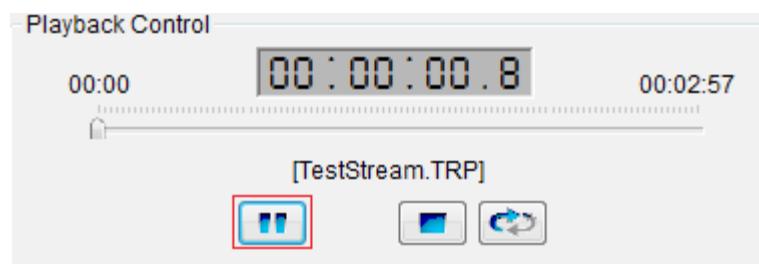
7.7 HOW TO USE TVB594.

TVB594 can generate up to 3-channel RF signal.
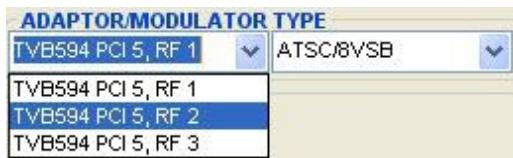
FIG. TVB594

When authorization key is updated, S/W(TPG0590VC) must be closed and started again.
FIG. TVB594 illustrates that there are 3 adaptors of RF1, RF2 and RF3 which generate 1st channel, 2nd channel and 3rd channel of RF signals respectively.

Setting frequency value just affect on RF1. RF2, and RF3 frequencies are calculated from RF1.
 ex) RF 1 frequency is 473MHz.
    RF 2 frequency is 479MHz.
    RF 3 frequency is 485MHz.

[ASI/310 TS IN] LoopThru or Recoding is only supported by RF 1.
Caution, while recording RF1, RF2 and RF3 can not play.

[ASI/310 TS OUT] When playing a file, the selected RF channel comes out from ASI/310 output.

Usage of other supported functions is similar to previous versions.(TVB590C)

7.8 MULTI-BOARD IP STREAMING IS SUPPORTED.(REFER TO PAGE29)

7.9 SET SATELLITE/LNB FREQUENCY.

[DVB-S/S2, ISDB-S] is supported.

In the menu bar, choose **Configuration, Output**. Click **Sat./LNB...**

Then, [Satellite / LNB Frequency] dialog will be shown.
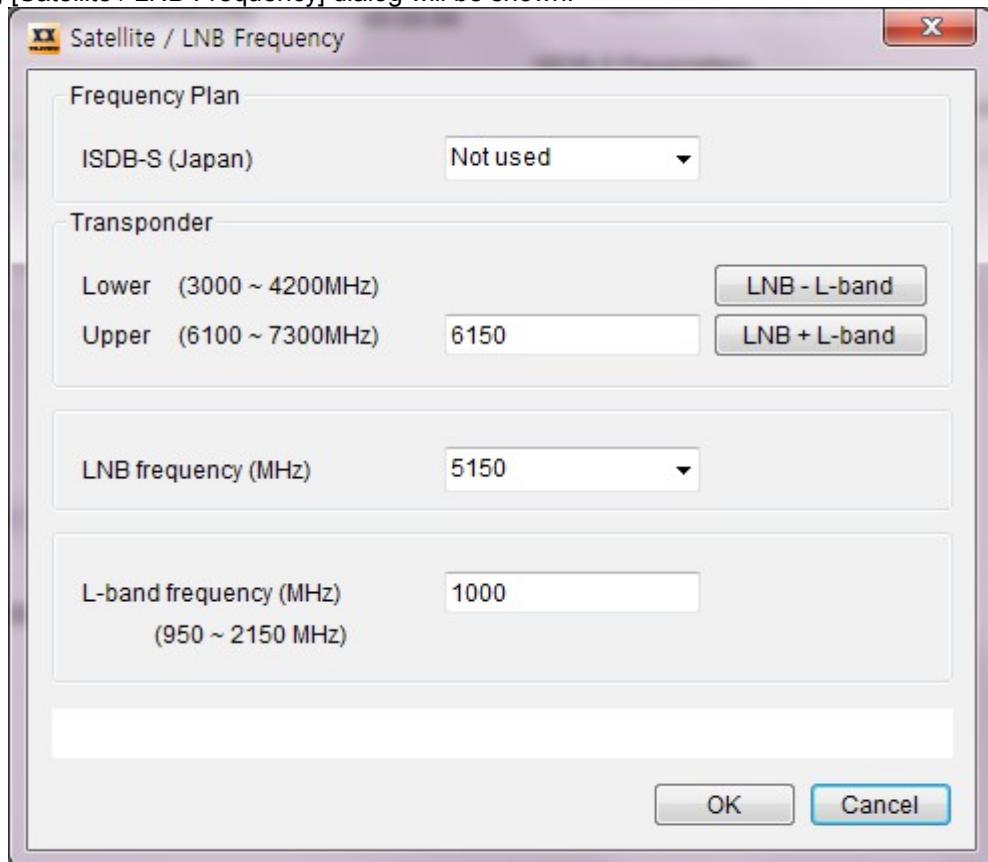
[Frequency Plan] only supports ISDB-S.

When one of channel items is chosen, Satellite/LNB/L-BAND Frequencies, are set by standard (can not be set manually). If you want to set Frequencies manually, choose "Not used" item.

[Transponder]

Input range is from (LNB Frequency(MHz) - 2150(MHz)) to (LNB Frequency(MHz) - 950(MHz)) and from (LNB Frequency(MHz) + 950(MHz)) to (LNB Frequency(MHz) + 2150(MHz)).

[LNB Frequency]

One of pre-set LNB Frequency can be chosen. LNB Frequency can be set manually, if you choose "manual input" from the LNB frequency list.

[L-BAND Frequency]

Input range is from 950(MHz) to 2150(MHz).

7.10 DEFAULT PID ASSIGNMENT FOR ISDB-T 13SEG.
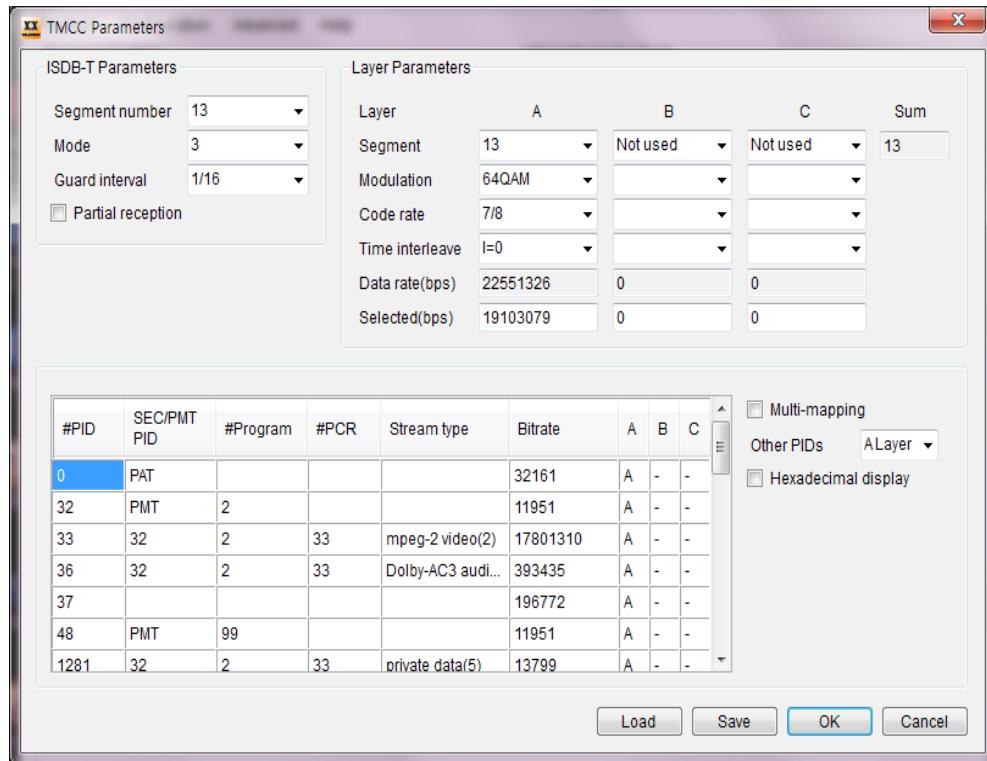
 Figure. TMCC Default Setting.
When 188-ts file is played out, all Pids are assigned to layer A and TMCC parameters are set as Figure TMCC Default Setting by default.
Caution: 188-ts bitrate must be less than DATA RATE.
        Maximum Data rate is 23234699bps.

7.11 AMPLITUDE EQUALIZER

The Amplitude displayed on TPG0590VC GUI is measured by Teleview.
It may be different from that measured by users.
Amplitude offset = User Level – Teleview Level
Please refer to the following example and adjust Amplitude offset to set the same level.

For example:
Frequency range : 400MHz ~ 500MHz (400 < frequency <= 500)
Amplitude measured by Teleview : -25dBm
Amplitude measured by user : -26dBm
Amplitude offset should be -1.
To set **Amplitude Equalizer**
 In the menu bar, choose **Configuration, Output**. Click **Amplitude Equalizer...**.
Then, **Amplitude Equalizer** dialog will be shown.
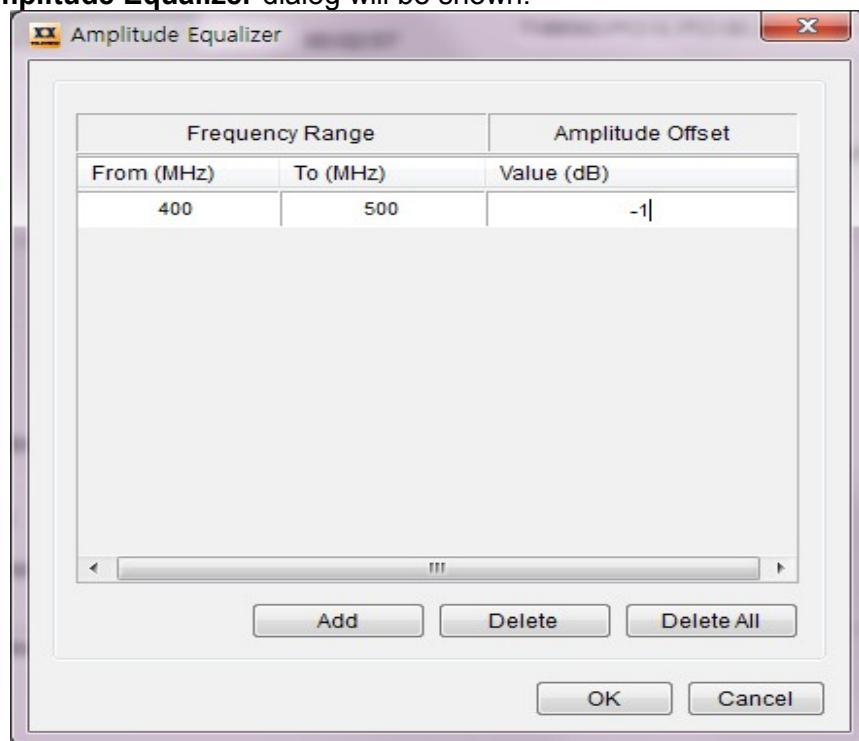
- Add : The new row is inserted below the selected row.
- Delete : Delete the selected row.
- Delete All : Delete all the rows.
- OK : Close the dialog and Save changes of [Frequency Range] table.
- Cancel : Close the dialog and Discard changes of [Frequency Range] table.
- From (MHz), To (MHz) : Input range is 48 ~ 2150(MHz).
                        FROM(MHz) value < TO(MHz) value.
                        From (MHz) value < RF Frequency (MHz) <= To (MHz) value.
- VALUE(dB) : Input range is -10 ~ 10.

7.12 NEW MODULATOR TYPES
   TPG0590VC version 7.6.0 or later can support .
   [TVB593, TVB591S] support new modulator types which are Multi-VSB and Multi-J.83/B.
   [Multi-VSB] TVB593 can generate up to 3-channel RF signal.(FIG. TVB593 Multi-VSB)
          TVB591S can generate up to 4-channel RF signal.(FIG. TVB591S Multi-VSB)
   [Multi-J.83/B] TVB593 can generate up to 4-channel RF signal.(FIG. TVB593 Multi-J.83/B)
          TVB591S can can generate up to 2-channel RF signal.(FIG. TVB593 Multi-J.83/B)
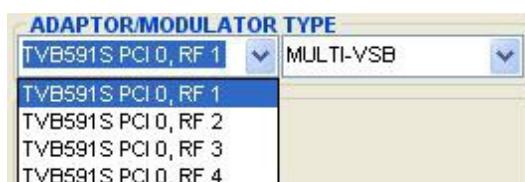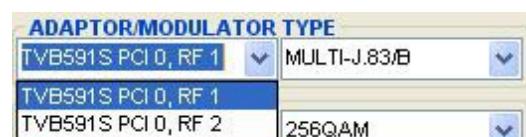
FIG. TVB591S Multi-VSB   FIG. TVB591S Multi-J.83/B
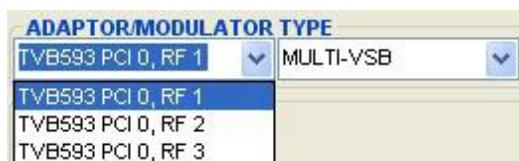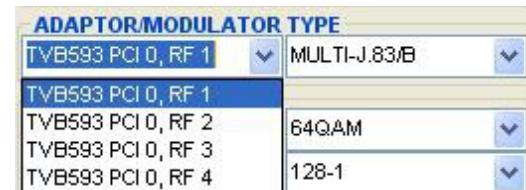
FIG. TVB593 Multi-VSB   FIG. TVB593 Multi-J.83/B

Adaptors of RF1, RF2, RF3 and RF4 generate 1st channel, 2nd channel, 3rd channel and 4th channel of RF signals, respectively.

Setting frequency value just affect on RF1. RF2, RF3 and RF4 frequencies are calculated from RF1.(The different frequency between Multi-VSB and Multi-J.83/B RF channel is 6MHz.)
 ex) RF 1 frequency is 473MHz.
    RF 2 frequency is 479MHz.
    RF 3 frequency is 485MHz.
    RF 4 frequency is 491MHz.

[ASI/310 TS IN] LoopThru or Recoding is only supported by RF 1.
Caution, while LoopThru or recording RF1, RF2, RF3 and RF4 can not play.

[ASI/310 TS OUT] When playing a file, the selected RF channel comes out from ASI/310 output.

[Multi-DVB-T] is supported for TVB593.
 - This option can generate up to 2-channel RF signal.
 - **TPG0590VC version 7.6.4 or later can support .**
TPG0590VC version 7.9.0 or later can support TVB598, TVB599A.

7.13 SINGLE TONE.

S/W : TPG0590VC version 7.6.0 or later can support .
H/W : [TVB593, TVB597A V2.x, TVB591S, TVB598, TVB599A] support this function.
Single tone is not supported at Multi-VSB and Multi-J.83/B option.

Single tone is only enabled while playing.
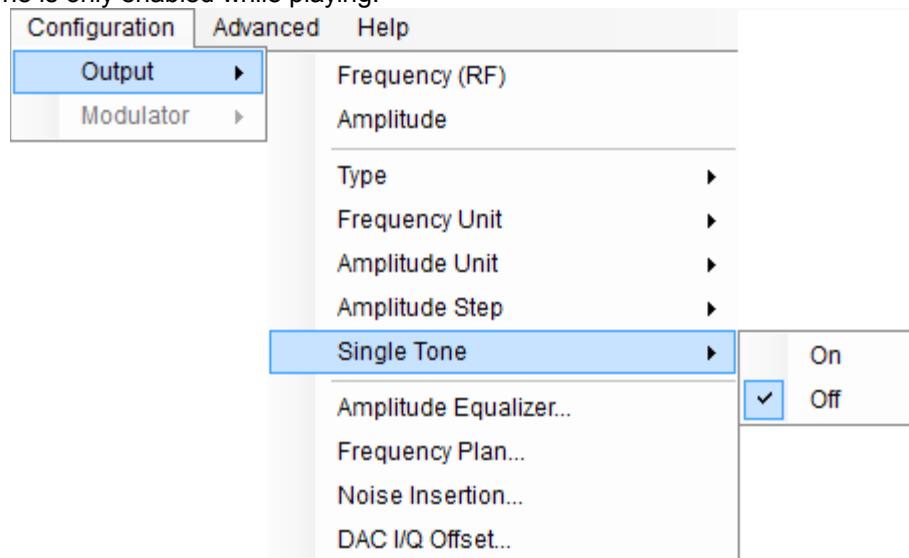
FIG. SINGLE TONE

If you check **On**, the single tone signal is enabled instead of RF modulation.
Default is **Off**. (FIG. SINGLE TONE)
The amplitude of single tone is the same as RF Amplitude that is displayed on GUI except for I/Q
PLAY mode. The reference amplitude of single tone in I/Q PLAY mode is fixed to 0dBm.
The frequency of single tone is the same as RF Frequency that displayed on GUI except for ISDB-
T option. The frequency of single tone in ISDB-T option is fixed to #### MHz unit.
ex> In case ISDB-T RF frequency is set to 473.143MHz, single tone frequency is fixed to
473MHz.

7.14 DVB-T2/C2 DVB-ASI DIRECT MODULATION.

S/W : TPG0590VC version 7.6.5 or later support .
H/W : [TVB593, TVB597A V2.x] support this function.
TVB593 ASI Input data rate range : 2Mbps ~ 45Mbps
TVB597A(Ver.2) ASI Input data rate range : 2Mbps ~ 32Mbps

7.15 RF AMPLITUDE CONTROL.

S/W : TPG0590VC version 7.6.7 or later support .
H/W : [TVB590S V3.x, TVB593, TVB597A V2.x, TVB591S, TVB598, TVB599A] support this function.
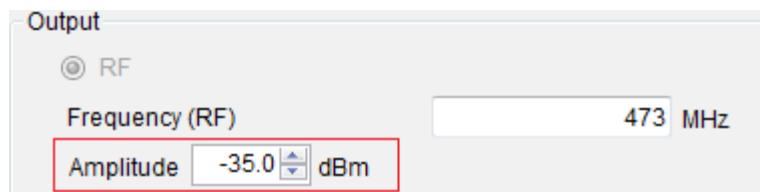
The new control method of Amplitude is shown level, is available to control it in a appropriate range and **Amplifier** is also controlled on or off automatically. The range of **Amplitude** appears when the mouse pointer is put on the **Amplitude**.

7.16 PCR RESTAMPING.

S/W : TPG0590VC version 7.6.8 or later support .
H/W : [TVB593, TVB597A V2.x(or later), TVB598, TVB599A] support.
Modulator Mode : DVB-T/H, ATSC (8VSB), DVB-C (J.83 A&C), QAM (J.83 B),
DVB-S/S2, DTMB

This function is to reset the PCR value in order to reduce the PCR inaccuracy.
In the menu bar, choose **Advanced**. Click **PCR Restamping...**.
Default is **On**.
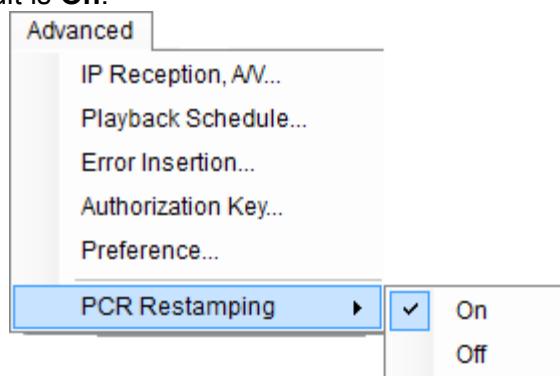
7.17 T2MI FILE GENERATION.
S/W : TPG0590VC version 7.7.3 or later support.

This function is supported in DVB-T2 mode.
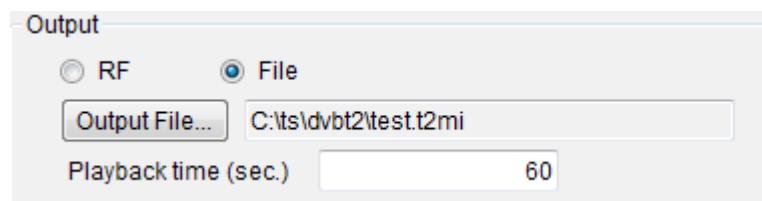
How to make T2MI file.
1. Click [Remux...], DVB-T2 T2MI Multiplexer dialog will be shown.
   Set parameters.(Refer to Page 29.)
2. Choose File.
   (File : T2MI file generation and No output RF signal
    RF : Output RF signal and No T2MI file generation)
3. Click [Output File...], set path and name of saved file.
    The extension of T2MI file is t2 or t2mi.
4. Set [Playback time (sec.)].

5. Click .
6. Display progress during T2MI file generation.
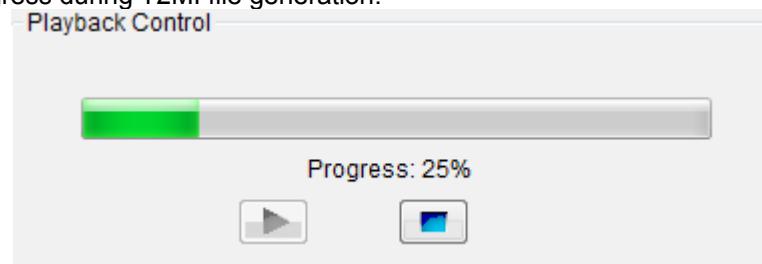
7.18 TS I/O MODE.
S/W : TPG0590VC version 7.7.3 or later support.

This mode is supported in following boards. TVB593, TVB597A (Ver.2 or later), TVB598, TVB599A
Output signal : DVB-ASI or SMPTE-310M.
Input source : File, DVB-ASI or SMPTE-310M.
Disabled RF control parameters. (RF frequency, Amplitude, etc.)

7.19 TS OUTPUT CONTROL.
S/W: TPG0590VC version 7.8.4 or later support.
H/W: TVB598, TVB599A